



**Australian Government**  
**Department of the Environment**



**Government of South Australia**  
**Department of Environment,  
Water and Natural Resources**

## **National Recovery Plan for the Plains-wanderer (*Pedionomus torquatus*)**



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Male and female plains-wanderers in grassland habitat (© Copyright, David Baker-Gabb).

The Species Profile and Threats Database pages linked to this recovery plan is obtainable from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

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# Acronyms

BHA	Bush Heritage Australia
CFA	Country Fire Authority (Vic)
DotE	Department of the Environment
DELWP	Department of Environment, Land, Water and Planning (Vic)
DEWNR	Department of Environment, Water and Natural Resources (SA)
DEHP	Department of Environment and Heritage Protection (Qld)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GFNC	Geelong Field Naturalists' Club
GMV	Game Management Victoria
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
IUCN CBSG	IUCN Conservation Breeding Specialist Group
MLLS	Murray Local Land Services
MNES	Matters of National Environmental Significance
NCCMA	North Central Catchment Management Authority
NCT	Nature Conservation Trust of NSW
NGO	Non-government organisation
NPSR	Department of National Parks, Sports and Racing (Qld)
NTAG	Northern Plains Grassland Technical Advisory Group
OEH	Office of Environment and Heritage (NSW)
PV	Parks Victoria
PwRT	Plains-wanderer Recovery Team
RLLS	Riverina Local Land Services
RFS	Rural Fire Service (NSW)
TfN	Trust for Nature Victoria
TTNP	Terrick Terrick National Park
TSSC	Threatened Species Scientific Committee
ZAA	Zoo and Aquarium Association

# 1 Summary

## Plains-wanderer (*Pedionomus torquatus*)

**Family:** Pedionomidae

**Current status of taxon:**

*Environment Protection and Biodiversity Conservation Act 1999:* Critically Endangered

*Threatened Species Conservation Act 1995 (New South Wales):* Endangered

*Advisory List of Threatened Vertebrate Fauna in Victoria:* Critically Endangered

*Flora and Fauna Guarantee Act 1988 (Victoria):* Threatened

*Nature Conservation Act 1992 (Queensland):* Vulnerable

*National Parks and Wildlife Act 1972 (South Australia):* Endangered

*IUCN Red List of Threatened Species:* Endangered

**Distribution and habitat:**

Plains-wanderers occur at scattered sites in New South Wales (NSW) and Victoria, which encompass the core sites for the species; and Queensland and South Australia, which appear to encompass more marginal habitat for the species. Plains-wanderers inhabit sparse, treeless, lowland native grasslands which usually occur on hard red-brown clay soils. Grassland structure is much more important than floristic composition with the species showing a strong preference for sites with approximately 50% bare ground and most vegetation less than 5 cm in height and some widely-spaced plants up to 30 cm. The plains-wanderer occasionally occurs in other types of habitat such as in stubble; amongst low cereal crops; and in low, sparse chenopod shrubland.

## Habitat critical for survival:

Habitat critical to the survival of the plains-wanderer includes:

- Any regions where the species is likely to occur; and
- Any newly discovered locations that extend the likely range of the plains-wanderer.

## Recovery plan objectives:

The objectives of this recovery plan are to:

- Reverse the long-term population trend of decline and increase the numbers of plains-wanderers to a level where there is a viable, wild breeding population, even in poor breeding years; and to
- Enhance the condition of habitat across the plains-wanderers' range to maximise survival and reproductive success, and provide refugia during periods of extreme environmental fluctuation.



## Recovery strategies:

The strategies to achieve the recovery plan's objectives are to:

- Develop and implement a robust, targeted conservation breeding strategy for the plains-wanderer.
- Facilitate management of grazing regimes, and improve knowledge of appropriate burning regimes, to maintain suitable habitat for plains-wanderers.
- Enhance protection, improve the quality and increase the extent of habitat suitable for the plains-wanderer.
- Identify the key factors that have contributed to the significant recent declines in the numbers of plains-wanderers and develop mitigation measures to address these threats.
- Improve understanding of the distribution and population trends of the plains-wanderer.
- Increase community participation in plains-wanderer conservation and management.



**Figure 1:** *Plains-wanderer male (left) and female (right) in sparse grassland habitat.*

## Criteria for success:

This recovery plan will be deemed successful if, within 10 years, all of the following have been achieved:

- A successful conservation breeding program for the plains-wanderer has been established.
- The number of plains-wanderers has increased from the very low levels recorded for the species in 2011-14.
- The area of occupancy has increased from the level known in 2011-14.
- A long-term monitoring program for the plains-wanderer and plains-wanderer habitat, has been implemented in the species' two strongholds - the Riverina region of New South Wales and the Northern Plains of Victoria; and assessment of population trends is indicative of a positive trajectory.
- Monitoring has been conducted in other known plains-wanderer locations.
- Threats impacting upon the survival of the plains-wanderer have been identified and assessed and appropriate management measures have been put in place.
- Habitat quality has improved across all key locations to the extent that reductions in exotic annual grass cover and increases in native grass cover have been observed.
- Fencing has been erected, in appropriate locations, to facilitate grazing management to soil type in key plains-wanderer habitats.
- Strategies have been developed and implemented to provide refugia (i.e. designated areas where habitat structure is maintained within key parameters for the plains-wanderer) during periods of extreme environmental fluctuation.
- A population response model, that identifies a realistic recovery time frame and trajectory, informed by knowledge of species biology and threats, has been developed and implemented for the plains-wanderer.

## Criteria for failure:

This recovery plan will be deemed to have failed if; within 10 years, any of the following have occurred:

- Known populations of the plains-wanderer have not recovered from the very low numbers, and limited area of occupancy, recorded in 2011-14.
- Regular monitoring has not been conducted and population trends have not been assessed in the plains-wanderer's two strongholds.
- Threats to survival have not been identified and appropriate mitigation measures have not been implemented.
- Habitat quality has not improved in key locations, resulting in the disappearance of plains-wanderers from these sites.

## 2 Introduction

This document constitutes the National Recovery Plan for the Plains-wanderer (*Pedionomus torquatus*). The plan considers the conservation requirements of the species across its range and identifies the actions to be taken to ensure the species long-term viability in nature, and the parties that will undertake those actions.

The plains-wanderer has recently been upgraded to Critically Endangered on the list of threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In recent years, significant declines in numbers of plains-wanderers have been recorded in the species core locations. Monitoring across the New South Wales Riverina between 2010 and 2014 detected a decline in numbers of 84%. This decline was preceded by significant fluctuations in numbers across the region from 2001 onwards, with an overall decline of 93% across the region over the period from 2001 to 2014 (Wilson et al., 2014). Monitoring and annual surveys, which have been conducted across the Patho Plains of Victoria since 2009 (Antos, 2015), indicated a decline in numbers of approximately 95% between 2010 and 2014 (Baker-Gabb, 2014). The current number of plains-wanderers is estimated to be somewhere between 250 and 1000 birds, representing a record low for the species (Baker-Gabb, 2015; OEH, 2015).

Over longer timeframes the primary threats to the survival of the plains-wanderer have been identified as habitat loss, primarily through the expansion of agriculture, and inappropriate grazing regimes. However, while recent declines in Victorian populations of plains-wanderers have been largely attributed to widespread flooding and inundation of habitat (Antos, 2015), there is uncertainty regarding the cause of the unprecedented recent declines in numbers across the species entire range. For this reason, one of the key focuses of this recovery plan is to identify the cause of recent declines, and mitigate any threats that have been found to be impacting upon the survival of the species.

The overall goal of this recovery plan is to achieve a viable, self-sustaining wild population capable of persisting through extended poor breeding seasons, and to put in place long-term management arrangements that ensure key plains-wanderer habitat is appropriately managed. To achieve this goal a range of strategies will be employed, including the development and implementation of a robust, targeted conservation breeding program and projects to facilitate management of grazing and burning regimes to maintain suitable habitat.

An accompanying Species Profile and Threats Database (SPRAT) page provides background information on the biology, population status and threats to the plains-wanderer. The SPRAT page is available from:

<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>



## 2.1 Conservation status

The plains-wanderer is listed as threatened under the EPBC Act as well as state and territory legislation across its range.

The plains-wanderer (*Pedionomus torquatus*) was transferred from the *Endangered Species Protection Act 1992* to the vulnerable list of the EPBC Act when it came into force in July 2000.

**Table 1:** International, national and state conservation status of the plains-wanderer.

Legislation	Conservation Status
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	Critically Endangered
<i>Threatened Species Conservation Act 1995</i> (New South Wales)	Endangered
<i>Nature Conservation Act 1992</i> (Queensland)	Vulnerable
<i>National Parks and Wildlife Act 1972</i> (South Australia)	Endangered
<i>Flora and Fauna Guarantee Act 1988</i> (Victoria)	Threatened
<i>Advisory List of Threatened Vertebrate Fauna in Victoria (2013)</i>	Critically Endangered
<i>IUCN Red List of Threatened Species: (2013)</i>	Endangered

## 2.2 Plains-wanderer Recovery Team

Recovery teams provide advice and assistance in coordinating actions described in recovery plans. They include representatives from organisations with a direct interest in the recovery of the species, including those involved in funding and those participating in actions that support the recovery of the species. Members are committed to the conservation of the species and the achievement of recovery objectives and implementation of recovery strategies.

The Plains-wanderer Recovery Team (PwRT) has the responsibility of providing advice and coordinating the implementation of the recovery actions outlined in this recovery plan. The membership of this recovery team may include individuals with relevant expertise from the Department of the Environment (DotE), the Office of Environment and Heritage (NSW) (OEH), the Department of Environment, Land, Water and Planning (Vic) (DELWP), the Department of Environment, Water and Natural Resources (SA) (DEWNR), the Department of Environment and Heritage Protection (Qld) (DEHP), Parks Victoria (PV), Melbourne Zoo, North Central Catchment Management Authority (NCCMA), Murray Local Land Services (MLLS), Riverina Local Land Services (RLLS), BirdLife Australia, Bush Heritage Australia (BHA), Trust for Nature Victoria, Country Fire Authority, independent researchers, community groups and landholders. Membership of the Recovery Team may change over time.

## 3 Background

### 3.1 Species description

The plains-wanderer is a small, quail-like bird that, when fully grown, measures 15-19 cm in length, has a wing-span of 28-36 cm, and has a mass of 40-80 grams in males and 55-95 grams in females (Marchant & Higgins, 1993). In adult plumage, the sexes differ in appearance. The males are light brown or buff above and mostly buff to orange-buff below, they have white and blackish markings over the body, spots and streaks on the head and neck and a white unmarked belly. The females have a broad black collar around the neck, with white streaks and spots, and a broad rufous patch on the upper breast. The females are also more brightly coloured than the males, and tend to be more yellow on the bill, iris, legs and feet, especially during the breeding season when the bill and legs can become orange-yellow (Marchant & Higgins, 1993). Juveniles resemble adult males, but they can be distinguished until 14 weeks of age by heavy dark-brown spotting (crescents) on their lower breast and flanks (Crome & Rushton, 1975).

### 3.2 Distribution

The plains-wanderer is usually seen singly, especially during the non-breeding season, but may also occur in pairs and in small family groups of up to five birds (Baker-Gabb, 1987; Bennett, 1983; Harrington et al., 1988; Marchant & Higgins, 1993). The plains-wanderer occurs at scattered sites in Queensland, New South Wales, Victoria and South Australia (Baker-Gabb, 1990a; Baker-Gabb et al., 1990; Barrett et al., 2003; Bennett, 1983). There have also been unconfirmed records of the species in the Northern Territory (Bennett, 1983; Blakers et al., 1984). The primary 'stronghold' of the species is the Riverina region of south-western New South Wales (Baker-Gabb et al., 1990; Bennett, 1983) with the north-central region of Victoria providing a secondary stronghold. Astrebla Downs National Park and Diamantina Lakes National Park represent areas of high importance for the species in Queensland, with potential plains-wanderer habitat linking these Queensland Channel Country sites to the Riverina region of New South Wales.

The distribution of the plains-wanderer was formerly more widespread; there are historical records from central, south-western and south-eastern Queensland; eastern, central and western New South Wales, mainly in the south; central and western Victoria; and south-eastern and inland South Australia (Bennett, 1983; Blakers et al., 1984; D'Ombrian, 1926; Llewellyn, 1975). The species is now mostly recorded from some smaller areas of critical habitat in south-western Queensland, south-western New South Wales, north-central Victoria, and north-eastern South Australia (Baker-Gabb, 1990a, 2002b; Baker-Gabb et al., 1990; Barrett et al., 2003; Bennett, 1983).

The extent of occurrence for the species is estimated to be 930 000 km<sup>2</sup> (Garnett et al., 2011). The extent of occurrence is likely to be stable at present (Garnett et al., 2011), but it has declined markedly since European settlement. Garnett et al. (2011) estimated the area of occupancy to be 330 km<sup>2</sup>, with a continuing declining trend.

### 3.3 Population trends

The plains-wanderer was formerly much more common and widespread (Bennett, 1983; Blakers et al., 1984; D'Ombrain, 1926; Llewellyn, 1975), but its distribution and population size have declined markedly due to the loss and degradation of sparse, lowland native grasslands, which are its preferred habitat (Baker-Gabb, 2002b; Baker-Gabb et al., 1990; Bennett, 1983). The loss of habitat is ongoing (NPWS, 2001; Webster, 2000), and recent surveys (Parker & Baker-Gabb, 2013; Radford et al., 2013) have shown that the species is likely to be more scarce now than it was in the 1990s.

Within the Patho Plains of Victoria the plains-wanderer population was estimated to have undergone a reduction in numbers of greater than 90% between 2010 and 2012 (Radford et al., 2013) and by 2014 the population on ten private paddocks on the Patho Plains are estimated to have declined by approximately 95% since 2010 (Baker-Gabb, 2014). Declines in numbers also appear to be similar for populations in Terrick Terrick National Park (Antos, 2014) and Avoca Plains (Baker-Gabb, 2012). Following several surveys during which there were no records of birds breeding on the Patho Plains or Avoca Plains (Baker-Gabb, 2014), a sub-adult pair was observed in late 2014, a male with four chicks was observed in early 2015 and a nest with eggs was recorded in late 2015, indicating that limited breeding has again been occurring in these areas (Antos, 2015). Two possible hypotheses are proposed to explain the reduction in numbers in Victoria; either the Victorian population has undergone a mass migration or it has experienced mass mortality (Radford et al., 2013). While there may be suitable habitat within inland Australia into which the Victorian plains-wanderer population could have migrated, there is no evidence for this (Antos, 2013b; Radford et al., 2013).

Within the Riverina region of New South Wales the plains-wanderer population was estimated to have undergone a reduction in numbers of approximately 75% during the 2002 drought, after which time there was only minor, staged increases in numbers between 2004 to 2010 (Parker & Baker-Gabb, 2013). Further population declines in the Riverina population of plains-wanderer subsequently occurred following the increased rainfalls experienced from late 2010 to 2012 (Parker & Baker-Gabb, 2013). Recent analysis of monitoring data collected between 2001 and 2014 indicates that there was an overall decline in numbers of 93% across sites in the Riverina region over this time period (Wilson et al., 2014).

The size of the plains-wanderer population is likely to vary with seasonal conditions. Studies by Baker-Gabb et al (1990) indicated that the Riverina population of plains-wanderer could vary by up to 80% from year to year in times of drought. Previously, plains-wanderer populations have been shown to recover from population declines associated with drought conditions and localised overgrazing (Baker-Gabb et al., 1990, Maher, 1997). However, Parker and Baker-Gabb (2013) noted that plains-wanderer numbers have now remained historically low for more than a decade.

## 3.4 Biology and ecology

### 3.4.1 Longevity

The life expectancy of plains-wanderers in the wild is unknown (Baker-Gabb, 2002a), but in captivity they are capable of surviving for at least eight years (Baker-Gabb, 1993b).

### 3.4.2 Diet

The plains-wanderer feeds on a mixture of seeds and leaves and invertebrates, with seeds and leaves accounting for nearly 60% of the annual diet. Seeds and leaves are taken from grasses (including native species of *Austrostipa*, *Sporobolus*, *Panicum*, *Austrodanthonia*, and *Eragrostis* and occasionally exotic species of *Vulpia*), chenopods (including species of *Atriplex*, *Maireana*, *Chenopodium* and *Sclerolaena*) and other plants (such as native species of *Asperula*, *Galium*, and *Euphorbia* and possibly exotic species of *Spergularia* and *Carthamus*). Native plants provide the majority of the seeds, while exotic species make only a minor contribution to the plains-wanderer's diet (Baker-Gabb, 1988). Invertebrates generally account for about 40% of the diet of plains-wanderers, except in spring, when the proportion of insects in their diet increases slightly (Baker-Gabb, 1988). The invertebrate food consists of insects (including beetles, ants, bugs, caterpillars and locusts) and spiders (Baker-Gabb, 1988; Bennett, 1983). Ants and beetles are the most common insect groups eaten throughout the year, while sucking bugs and caterpillars are taken mainly in spring and autumn. The plains-wanderer forages during the day and at dusk in areas of sparse grass (Baker-Gabb, 1988, 2002a).

### 3.4.3 Movement patterns and habitat use

The plains-wanderer is a sedentary species that may undertake some movements in response to changes in the suitability of habitat, although most birds that have been banded have been recaptured within 400 m of their original banding sites (Baker-Gabb, 2002a; Baker-Gabb et al., 1990; Harrington et al., 1988). In the Riverina region, the home range of individual plains-wanderers vary in size from 7-21 ha (average size is 12 ha) in suitable habitat (Baker-Gabb et al., 1990). As about half of a pairs' home range overlaps, a pair requires about 18 hectares to breed. Home ranges are almost certainly larger in more arid areas (Baker-Gabb, pers comm., 2006). The size of the home range also varies from year to year depending on seasonal conditions (Baker-Gabb, 2002a).

### 3.4.4 Breeding

Plains-wanderers breed in solitary pairs in a territory defended by the larger female, though they can be serially polyandrous. They are capable of breeding in their first year (Baker-Gabb et al., 1990). The nest is a hollow or 'scrape' that is scratched into the ground and lined with grass, with nests placed amongst native grasses and herbs, or rarely amongst crops (Harrington et al., 1988; Keartland, 1901; North, 1913-1914; Souter, 1938; Sutton, 1927). Clutch-size is usually four (Bennett, 1983; North, 1913-1914), but can range from two to five (Bennett, 1983). The male does most of the incubation during the 23 day incubation period and is also primarily responsible for attending the young (Baker-Gabb, 1990b; Baker-Gabb et al., 1990; Bennett, 1983; Ridley, 1986). At this time the female may pair with and lay a clutch for a second male to incubate. Young birds gain independence at about two months (Baker-Gabb, 1990b).

Breeding success is often linked to environmental conditions. There may be no breeding during drought years and success can also be very low in years of heavy rainfall (Baker-Gabb et al., 1990; Harrington et al., 1988; Maher, 1997). However, if there is sufficient moderate

rainfall during summer, females will often produce a second clutch (Baker-Gabb et al., 1990; Harrington et al., 1988).

### 3.4.5 Habitat

The plains-wanderer inhabits sparse, treeless, species-rich, lowland native grasslands with approximately 50% bare ground, 40% herbs and grasses and 10% fallen litter, with grass tussocks spaced around 10-20 cm apart and most vegetation less than 5 cm in height and some widely-spaced plants up to 30 cm high, which provide shelter and concealment from predators (Baker-Gabb, 1987, 1990b, 2002a; Garnett et al., 2011; Harrington et al., 1988). These grasslands usually occur on hard, red-brown clay soils that do not support dense pasture growth under most conditions. The structure of the grassland is more important than the species composition in determining its suitability for the plains-wanderer (Baker-Gabb, 1987, 1990b, 2002a; Harrington et al., 1988; Llewellyn, 1975), with the species known to actively avoid areas of dense grass or other vegetation (Baker-Gabb, 1988), and exhibit a strong preference for native grasslands with a sparse structure (Baker-Gabb et al., 1990). Analysis of New South Wales survey data collected between 2001 and 2014 indicated that grass height is a significant predictor of abundance for plains-wanderers, with abundance negatively correlated with increased grass height (Wilson et al., 2014).

Plains-wanderers do not require regular access to water bodies and instead fulfil their hydration requirements through the food they consume and via pecking dew and rain drops from leaves (Baker-Gabb, 1988). Lichens and numerous perennial plants, including yellow buttons (*Chrysocephalum apiculatum* and *Chrysocephalum* sp1), have been recorded in areas with high-quality plains-wanderer habitat. Other frequently recorded plant species include ringed wallaby grass (*Austrodanthonia caespitosa*), pale beauty heads (*Calocephalus sonderi*), windmill grass (*Chloris truncata*), slender bluebush (*Maireana pentagona*), speargrass (*Austrostipa 'variabilis' complex*), and barley grass (*Hordeum leporinum*) (Baker-Gabb 1990b). Two species, fairy grass (*Sporobolus caroli*) and chariot wheels (*Maireana cheelii*), have been demonstrated to occur significantly more often in sparse grasslands than dense grasslands (Baker-Gabb 1987). The plains-wanderer occasionally occurs in other types of habitat: it has been recorded in cereal stubble, and amongst low crops of cereal grasses (Bennett, 1983; Llewellyn, 1975; Souter, 1938; Sutton, 1927), and in low, sparse chenopod shrublands (Harrington et al., 1988). However, it is unknown as to whether plains-wanderers can persist in these habitats over extended timeframes.

Surveys also indicate that plains-wanderers appear to avoid being in close proximity to living or dead trees, with no records of any birds within 300 m of trees of 10 m or greater in height across their strongholds in New South Wales and Victoria (Baker-Gabb, 2014). Plains-wanderer avoidance of trees and tall shrubs appears to be a defence strategy to limit the potential for attack by predatory birds that often perch in these trees. The distance plains-wanderers maintain from trees appears to depend on the height of the tree (Baker-Gabb, 2014).

Garnett et al (2011) estimated the extent of occurrence of plains-wanderers to be 930 000 km<sup>2</sup>, however the species' actual area of occupancy was estimated to be only 330 km<sup>2</sup> and decreasing. Given the historically low population size and the fragmented distribution of the plains-wanderer, all areas in which birds are found, and any suitable but currently unoccupied habitat within the species' extent of occurrence, represent habitat critical to the survival of the species.



### **3.4.6 *Habitat critical to survival***

Habitat critical to the survival of the plains-wanderer includes:

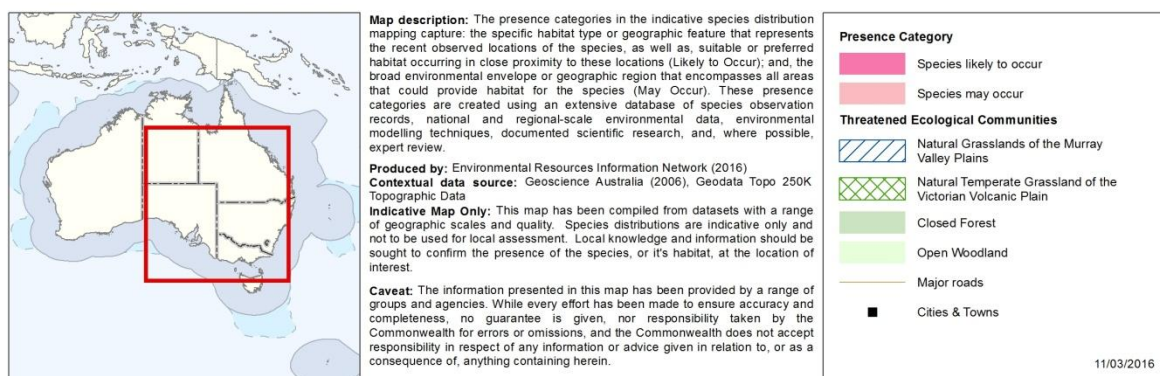
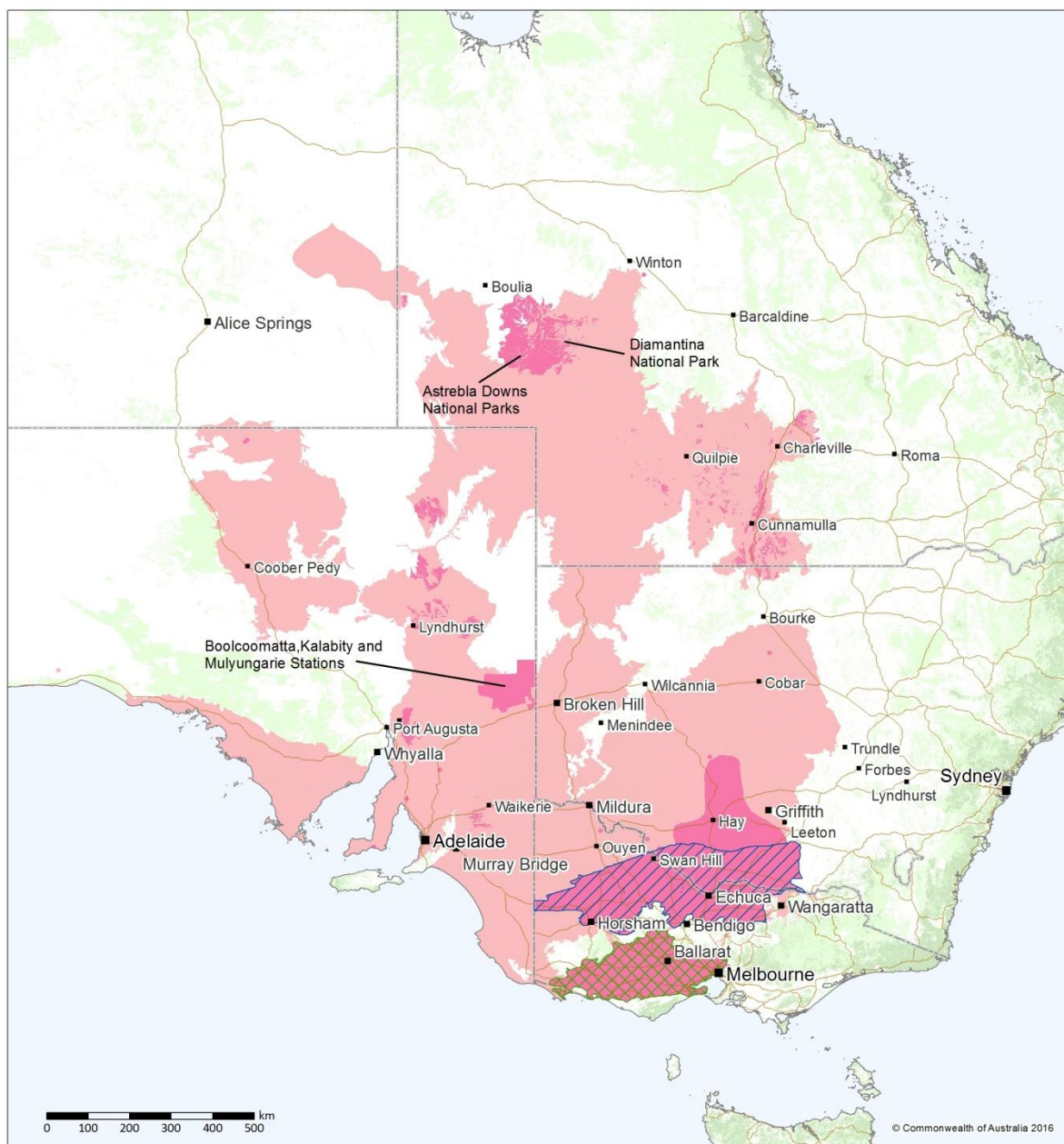
- Any regions where the species is likely to occur (as defined by the distribution map provided in Figure 2); and
- Any newly discovered locations that extend the likely range of the plains-wanderer.

Key areas include the Riverina region of south-west New South Wales and the Northern Plains in north-central Victoria (Table 2; Figure 2).

Habitat critical to the survival of the species occurs in a wide range of land ownership arrangements, including on private land and leaseholds, travelling stock routes, National Parks and Nature Conservation Reserves and other conservation managed lands. It is essential that the highest level of protection is provided to these areas and that enhancement and protection measures target these productive sites.

**Table 2:** Current distribution of plains-wanderer and key threats.

State/Territory	Distribution	Tenure	Threats
New South Wales	Riverina region of south-western NSW, in the area bounded by the Cobb Highway between Deniliquin and Willandra National Park to the west, Narrandera and Urana to the east, and Billabong Creek to the south. Known, scattered records from and to the south of Deniliquin.  Occasional sighting in grasslands and other veg types in western NSW.	National Parks	Small population
		Travelling stock routes	Inappropriate habitat management
		Privately-owned lands	Prolonged drought
		Commonwealth Defence Land	Wildfire
		RailCorp land	Habitat loss Feral predators Pesticide use
Victoria	Northern Plains in north-central Victoria, which surrounds Terrick Terrick National Park, Bael Bael Nature Conservation Reserve and Trust for Nature's Wanderers Plain, bounded by the Murray Valley Highway to the north, the Northern Highway to the east, Birchip in the west, and the wooded foothills to the south.  Victorian Volcanic Plain.  Western Grassland Reserve immediately west of Melbourne.	National Parks and Nature Conservation Reserves	Small population Habitat loss Inappropriate habitat management
		Trust for Nature managed lands	Flooding Quail hunting
		Privately-owned lands	Feral predators
			Pesticide use
Queensland	Channel country in the far west of the state, with records concentrated in the northern reaches of Astrebla Downs National Park, the southern reaches of Diamantina Lakes National Park, and on Sandringham Station, and with scattered records of the species in native grasslands extending east and south-west from this region.	National Parks	Small population Inappropriate habitat management
		Privately-owned lands	Feral predators
		Leasehold land	Lack of knowledge of distribution of key populations and habitat
South Australia	Willochra Plain north-east of Quorn, and in some adjacent areas of the southern Flinders Ranges, and north of the Barrier Highway (and west of Broken Hill) on Kalabity, Boolcoommatta, Bundera and Mulyungarie Stations, also irregularly occurs in the arid regions of northern South Australia.	Bush Heritage Australia managed land	Small population Inappropriate habitat management
		Privately-owned lands	Feral predators
			Lack of knowledge of distribution of key populations and habitat



**Figure 2: Modelled distribution of the plains-wanderer (*Pedionomus torquatus*)**

# 4 Threats

## 4.1 Historical causes of decline

Historically, the major factor contributing to the decline of the plains-wanderer was habitat loss as a result of the widespread conversion of lowland native grasslands to crops and dense introduced pastures (Baker-Gabb, 1998; Bennett, 1983). The loss of habitat has been widespread and extensive, and has caused the distribution of the species to contract markedly. The plains-wanderer is now locally-extinct or near extinct in coastal and sub-coastal areas in all four states in which it is known to occur, and is mainly confined to small inland areas that are subject to grazing (Baker-Gabb, 1998, 2002b; Bennett, 1983; Blakers et al., 1984; Llewellyn, 1975).

## 4.2 Current threatening processes

### **4.2.1 Habitat loss**

Habitat loss is an ongoing threat for the plains-wanderer, both as a direct result of continued conversion of land for the cultivation of crops and an indirect result of the legacy of habitat fragmentation that has resulted from past land conversion. The replacement of native grasslands with introduced pasture or crops can impact on the plains-wanderer in a variety of ways. The widespread replacement of native grasslands in south-eastern Australia has caused the habitat of the plains-wanderer to become fragmented, and this has subsequently caused populations of the plains-wanderer to become isolated from one another (Baker-Gabb, 2002b). The application of fertilisers, or the sowing of introduced species of pasture plants, causes the density of grasslands to increase, and can also encourage the growth of environmental weeds, which render habitats unsuitable for inhabitation by the plains-wanderer, and lead to the temporary or permanent displacement of plains-wanderer populations (Baker-Gabb, 1998, 2002b). Similarly, if vegetation dynamics in a region are altered in a manner that leads to the thickening of vegetation, and incursion of woody vegetation into native grasslands, this can also result in a reduction in the availability of habitat suitable to plains-wanderers. However, active management of grassland vegetation can assist the recovery of habitat values appropriate for plains-wanderers and provide suitable habitat in key population strongholds (Wong et al., 2010). Similarly, with appropriate management and resourcing, former cropping land can be restored to provide suitable plains-wanderer habitat (Antos, 2014).

### **4.2.2 Inappropriate grazing**

Whilst grazing is an important component of plains-wanderer management, both overgrazing and insufficient grazing have the potential to negatively impact upon the species. Plains-wanderers have been shown to co-exist with light to moderate grazing (Baker-Gabb et al., 1990; Deiz & Foreman, 1996). Photographic guides for visually assessing the grassland structure preferred by plains-wanderers have been developed by both New South Wales Parks and Wildlife Service (Parker and Oliver, 2006) and Parks Victoria (PV, 2014), and can be used as an aid for managing grazing for the species. Although appropriately managed grazing may be unlikely to have a negative impact on the grassland structure (Wong & Morgan, 2012) upon which plains-wanderers rely, further research is required into the effects that various grazing regimes have on the food resources available to the species.

### *Droughts and extended dry periods with overgrazing*

The overgrazing of native grasslands by domestic livestock and rabbits (*Oryctolagus culiculus*), particularly during drought conditions, can result in the temporary displacement of the species from areas of preferred habitat on a local or regional scale, and an increase in the rate of mortality (Baker-Gabb, 2002b; Baker-Gabb et al., 1990; D'Ombrian, 1926; Harrington et al., 1988; NPWS, 2002). Plains-wanderers can co-exist with light to moderate grazing (Baker-Gabb et al., 1990, Deiz & Foreman, 1996), however during droughts and prolonged dry periods very light grazing, or no grazing, is required to maintain suitable habitat structure (Antos, 2013a). The use of strategic grazing, including fenced stock containment or exclusion areas (which are particularly important during drought conditions), may optimise plains-wanderer habitat cover.

### *Excessively wet periods with insufficient grazing*

An absence of grazing, or insufficient grazing, when followed by, or following, widespread rainfall and prolific grass growth, can also be deleterious to the species (Baker-Gabb, 2002b; NPWS, 2002, Radford et al., 2013) because it allows the density and/or height of grasses to increase which, consequently, can render native grasslands unsuitable for inhabitation by the plains-wanderer. Under prolonged wet conditions, a substantial increase in grazing intensity is required (Antos, 2013a). It has been hypothesized that unusually heavy rainfall in winter may be particularly problematic for plains-wanderers as it can result in a proliferation of dense introduced grasses and weeds (Baker-Gabb, 1998). Whereas heavy rainfall in summer may not always lead to the creation of dense grasslands that are unsuitable for plains-wanderers as it is more likely to cause increased growth of native grasses which the birds may tolerate (Wilson et al., 2014). Furthermore, some grassland habitats may become inundated for prolonged periods following significant rainfall events (Wilson et al., 2014) with grassland structure potentially taking three years to return to a suitable condition for plains-wanderers following flooding after heavy rainfall events (Antos, 2015).

#### **4.2.3 Small population**

Plains-wanderers may be exposed to increased extinction risk due to their current historically low population size. Small populations are at increased risk of extinction as chance events may have significant impacts on the population (Caughley, 1994). Such events could include random variations in the encounter and breeding rate or the ratio of male to female offspring. Random fluctuations in environmental conditions or the availability of food and other resources may also impact on small populations. Other potential issues that can impact upon the survival of a small population include reduced genetic diversity and fitness, and the potential for inbreeding depression (Caughley, 1994).

#### **4.2.4 Predation by feral species**

European foxes (*Vulpes vulpes*), feral cats (*Felis catus*) and native birds of prey, such as the spotted harrier (*Circus assimilis*) and black falcon (*Falco subniger*) are all potential predators of the plains-wanderer (Baker-Gabb, 2002b; Llewellyn, 1975; NPWS, 2002). Predation by foxes is considered a major threat to the species in New South Wales (Llewellyn, 1975), although it is unclear as to the relative importance of this threat (Harrington et al., 1988). It is also possible that predators could pose an increased threat to the plains-wanderer around cultivated land where greater numbers of mice might attract and sustain larger populations of the potential predators (Baker-Gabb, 1998, 2002b; NPWS, 2002). Feral cats are also likely to kill plains-wanderers, although cats, unlike foxes, are not regularly recorded in open grassland habitats where plains-wanderers occur. As plains-wanderer nests are located on the ground their eggs may also be vulnerable to predation, however the occurrence and/or extent of this threat are unknown.



#### **4.2.5 Pesticide use**

In the 1990s and prior, broad-spectrum pesticides such as fenitrothion [and fipronil] were periodically sprayed from the air over a large proportion of plains-wanderer habitat (Baker-Gabb, 1993; Story & Cox, 2001; Symmons, 1985), in particular to control the Australian plague locust (*Chortoicetes terminifera*). However, since 2004 the Australian Plague Locust Commission (APLC) has largely replaced the aerial application of chemical pesticides with the use of a biological control agent, *Metarhizium acridum* commonly known as Green Guard, within primary and secondary plains-wanderer habitat (Story et al., 2007). In August 2010 the APLC agreed, in collaboration with the New South Wales Office of Environment and Heritage, to an operational policy specifying that *Metarhizium* will be the only locust control agent applied within 1,500 m upwind of mapped primary and secondary plains-wanderer habitat (Adriaansen, pers comm., 2015). Furthermore, APLC annual reports show that aerial spraying for plague locust control has occurred only sporadically over the past decade (APLC, 2015).

While APLC policy provides safeguards that may greatly reduce, or potentially negate, the impacts of plague locust control activities on plains-wanderers, a range of broad-spectrum pesticides [including fenitrothion and fipronil] are available for sale to the Australian public through major chemical supply companies. In New South Wales the use of chemicals on farms is regulated by state legislation and farmers are required to keep records of their usage (NSW LLS, 2015). However, there is no mechanism for individual landholder's records of pesticide usage across the plains-wanderer's range to be reported back to a central repository. Thus the total amount of pesticide exposure to the species is unknown. Furthermore, as ground-level pesticide application can involve different application rates and methodologies to aerial spraying, the toxicological and environmental risk profiles associated with private landholder usage are also not clearly understood.

A review of safety data literature for *Metarhizium anisopliae* [*M. acridum* was previously recognised as a variety of *M. anisopliae*] indicates that no negative effects have been observed in birds following exposure to, or ingestion of, the fungus (Zimmermann, 2007). However, the effects of fenitrothion and fipronil on plains-wanderers are largely unknown. In one study avian mortalities were recorded in other bird species exposed to fenitrothion at application rates of eight ounces/acre (Pearce, 1971), however this rate is significantly greater than the application rate used by the APLC during locust control activities. International studies on the effects of repeated sublethal exposure to fenitrothion have documented reduced avian reproductive output and success as a result of disruptions to breeding activity and reductions in the number of young fledged (Varty, 1980); and inability to defend territory, territory abandonment and clutch desertion (Busby et al., 1990). Australian studies on the effects of sublethal fenitrothion exposure in birds have recorded potentially detrimental impacts to reproduction and feeding in a number of species (Fildes et al., 2006a; 2006b; 2009).

Furthermore, while policies regarding aerial spraying of insecticides in mapped plains-wanderer habitat should negate direct impacts to the species, this activity may still pose an indirect threat through impacts to food webs if the spraying outside of plains-wanderer habitat impacts on food abundance within areas that contain plains-wanderers.

At the time of writing this recovery plan, there had been no studies to indicate that broad scale declines in plains-wanderer numbers were associated with pesticide use. It is currently unknown as to whether pesticide use, either by way or aerial or on-ground application, is having any direct or indirect effects on plains-wanderer numbers.

#### **4.2.7 Planting and natural recruitment of trees in or near native grasslands.**

Plains-wanderers appear to avoid being in close proximity to living or dead trees, with no records of any birds within 300 m of trees of 10 m or greater in height across their strongholds

in New South Wales and Victoria (Baker-Gabb, 2014). Plains-wanderer avoidance of trees and tall shrubs appears to be a defence strategy to limit the potential for attack by predatory birds that often perch in these trees; furthermore the distance plains-wanderers maintain from trees appears to depend on the height of the tree (Baker-Gabb, 2014). Planting of trees is also a threat to the flora of native grasslands (DSE, 2010).

#### **4.2.8 Other potential threatening processes**

- High-intensity, large-scale fires can degrade or destroy plains-wanderer habitat, particularly following high rainfall when grassland habitat has become dense and tall and can provide increased fuel loads for wildfires of above-average severity and extent. Plains-wanderers can recolonise grasslands post-fire and have been observed to do so within 18 months when the disturbance event has been combined with grazing (Antos, 2014). However, it is unclear how long it may take for grasslands to regenerate to a level which allows birds to recolonise and reach pre-fire abundances. Furthermore, the time required for habitat to become suitable post-fire in the absence of grazing is unknown, although associated avifauna have been observed in suitable habitat within six months of burning events (NTAG, 2010).
- A lack of appropriate burning regimes may also be impacting upon the availability of suitable plains-wanderer habitat. Controlled low intensity fires can be a useful tool to manage grassland composition by reducing the dominance of weeds (Wong & Morgan, 2012) and short-lived, winter-growing native species, in particular spear grass (Sinclair, 2014), removing dead plant material, and allowing longer-living summer growing species to flourish (NTAG, 2010). This may be an important part of the management regime in maintaining plains-wanderer habitat as, in the absence of fire and under the presence of grazing, certain prolific grass species (e.g., rough spear grass) may dominate after high rainfall events and close out available foraging space (NTAG, 2010). In addition, fire appears to increase the stability of the system through promoting biological soil crusts (Wong & Morgan, 2012), maintaining spatial variability (Wong, 2012) and reducing climate driven fluctuations in functional traits (Wong, 2012). These changes may also promote flowering in many herbaceous species, which might result in an increase in resources for species such as the plains-wanderer. Further research is required into the effects that various fire regimes have on habitat availability, food resources available to the species and the reproductive success of small populations.
- Plains-wanderers can occasionally be killed during the quail hunting season as they look superficially similar and are found in the same habitat. Stubble quail (*Coturnix pectoralis*) are a native quail species that can be legally hunted in Victoria. The majority of hunting occurs on private property. There are also 16 State Game Reserves in which hunting is permitted (GMA, 2014). The degree to which quail hunting is impacting upon plains-wanderer survival is largely unknown; however hunting has the potential to have adverse impacts upon the species due to both incidental shooting and interactions between birds and dogs.
- Climate change is likely to impact upon plains-wanderer survival in the future. Within an Australian context predicted future weather conditions may include more frequent and severe bushfires, longer heatwaves, reduced rainfall in southern and eastern areas of Australia and an increase in the extremity and frequency of intense rainfall events causing local flooding (State of the Environment Committee, 2011). A key strategy to mitigate this threat will be to build resilience into the grasslands upon which plains-wanderers rely by reducing annual weeds and increasing native, perennial grasses and herbs, particularly those that persist and provide resources during extreme conditions.

## 5 Populations under particular pressure

The actions described in this recovery plan are designed to provide ongoing protection for the plains-wanderer throughout the species' range.

The plains-wanderer is thought to occur in a single widely-dispersed population, rather than in multiple populations (Garnett & Crowley, 2000), but the evidence for this is not strong. The plains-wanderer was formerly much more common and widespread (Bennett, 1983; Blakers et al., 1984; D'Ombra, 1926; Llewellyn, 1975), but its distribution and population size have declined markedly due to the loss and degradation of sparse, lowland native grasslands, which are its preferred habitat (Baker-Gabb, 2002b; Baker-Gabb et al., 1990; Bennett, 1983). Ongoing declines in population size and habitat availability present significant challenges for the recovery of the plains-wanderer and exert strong pressures on the species' survival in the wild. Given these challenges all populations and locations of plains-wanderers require protective measures.

## 6 Objectives and strategies

The objectives of this recovery plan are to:

- Reverse the long-term population trend of decline and increase the numbers of plains-wanderers to a level where there is a viable, wild breeding population, even in poor breeding years; and to
- Enhance the condition of habitat across the plains-wanderers' range to maximise survival and reproductive success, and provide refugia during periods of extreme environmental fluctuation.

The strategies to achieve the plans' objectives are:

- Develop and implement a robust, targeted conservation breeding strategy for the plains-wanderer.
- Facilitate management of grazing regimes, and improve knowledge of appropriate burning regimes, to maintain suitable habitat for the plains-wanderer.
- Enhance protection, improve the quality and increase the extent of habitat suitable for the plains-wanderer.
- Identify the key factors that have contributed to the significant recent declines in the numbers of plains-wanderers and develop mitigation measures to address these threats.
- Improve understanding of the distribution and population trends of the plains-wanderer.
- Increase community participation in plains-wanderer conservation and management.

## 7 Actions to achieve specific objectives

Actions identified for the recovery of the plains-wanderer are described below.

It should be noted that some of the objectives are long-term and may not be achieved prior to the scheduled five-year review of the recovery plan. Priorities assigned to actions should be interpreted as follows:

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**Priority 1:** Taking prompt action is necessary in order to mitigate the key threats to the plains-wanderer and also provide valuable information to help identify long-term population trends.

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**Priority 2:** Action would provide a more informed basis for the long-term management and recovery of the plains-wanderer.

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**Priority 3:** Action is desirable, but not critical to the recovery of the plains-wanderer or assessment of trends in that recovery.

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## Strategy 1: Develop and implement a robust, targeted conservation breeding strategy for the plains-wanderer.

### Research Actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>1a</b>	Develop a captive breeding strategy for the plains-wanderer.	1	<ul style="list-style-type: none"> <li>A workshop is held to develop a captive breeding strategy for the plains-wanderer, and establish the objectives, scale and nature of a captive breeding program.</li> </ul>	<b>DotE</b> <b>OEH</b> <b>DELWP</b>  ZAA PwRT IUCN CBSG	\$15 000
<b>1b</b>	Develop a Population Response Model for the plains-wanderer to inform the ongoing management of a captive breeding program for the species.	2	<ul style="list-style-type: none"> <li>A population response model is developed and achieves the following objectives: <ul style="list-style-type: none"> <li>- a realistic recovery time frame and trajectory, informed by knowledge of species biology and threats, is identified,</li> <li>- the outcomes of observed population fluctuations can be predicted, and</li> <li>- the effectiveness of recovery actions can be assessed.</li> </ul> </li> </ul>	<b>OEH</b> DELWP ZAA PwRT	Core government business <i>(collaborating with research community)</i>

### On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>1c</b>	Implement the captive breeding strategy and establish a captive population of plains-wanderers.	1	<ul style="list-style-type: none"> <li>The captive breeding strategy developed under action 1b is implemented.</li> <li>A captive population of plains-wanderers is established and meets the agreed objectives of the captive breeding program (as determined under 1b).</li> </ul>	<b>OEH</b> <b>DELWP</b> ZAA DEWNR	\$500 000 pa



## Strategy 2: Facilitate management of grazing regimes, and improve knowledge of appropriate burning regimes, to maintain suitable habitat.

### Research Actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>2a</b>	Study the roles of burning and slashing in maintaining and improving the condition of plains-wanderer habitat in National Parks and Reserves, and other lands managed for conservation.	1	<ul style="list-style-type: none"> <li>The potential for ecological burns to be used to manage plains-wanderer habitat (including impacts and response of vegetation) is investigated.</li> <li>A joint framework is developed and implemented to learn lessons from the various fire management methods being used across plains-wanderer habitat (e.g. by NP, TFN etc.) and to improve and coordinate future management of the species and its habitat.</li> </ul>	DELWP PV OEH TfN NTAG Research community	\$30 000 pa <i>(for four year PhD project)</i>

### On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>2b</b>	Facilitate grazing management to soil type and enable landholders to maintain suitable grassland biomass on red soils.	1	<ul style="list-style-type: none"> <li>Wherever possible, stock are rotated through, or confined to, fenced paddocks to maintain grassland biomass to desired levels for plains-wanderers in key habitat.</li> <li>An incentive program is developed to provide funding for landholders to fence paddocks and/or key habitat patches, or implement other methods for improving grazing management, in key plains-wanderer habitat.</li> </ul>	DELWP OEH PV MLLS NCCMA RLLS TfN BHA	\$80 000 pa <i>(for five year incentive program to fence twenty farms at \$20 000 ea)</i>
<b>2c</b>	Closely monitor grazing impacts on public and private reserves where grazing regimes are being managed for plains-wanderers to ensure grassland structure remains within acceptable limits for the species.	1	<ul style="list-style-type: none"> <li>Grassland structure and broad composition is monitored regularly, on both public and private protected areas, where grazing regimes are being managed for plains-wanderers.</li> <li>Managers respond quickly and effectively to ensure grassland structure remains suitable (i.e. 13-17 golf balls score, Parks Victoria 2008<sup>1</sup>; NSW, 2007) on reserves being managed for plains-wanderers.</li> <li>During dry periods (late spring to autumn break), or declared droughts, stock exclusion from public areas is implemented as appropriate.</li> </ul>	DELWP PV OEH TfN MLLS RLLS	\$100 000 pa

<sup>1</sup> Parks Victoria (2014). *Parks Victoria Grassy Ecosystems Monitoring Protocol*. Parks Victoria, Melbourne.

<b>2d</b>	Design and implement a habitat management strategy for all lands in which plains-wanderers are a management target.	1	<ul style="list-style-type: none"> <li>Site specific management strategies, with appropriate grazing and burning protocols, are developed for areas within National Parks, the National Reserve System and other lands for which plains-wanderers are a management target.</li> <li>Management practices are reviewed to ensure best practice is being implemented. National Parks and Reserves and other lands where plains-wanders are a management target.</li> </ul>	<b>OEH</b> <b>DELWP</b> <b>PV</b> <b>TfN</b> <b>NTAG</b>	\$50 000 for Victorian reserves  \$30 000 for NSW National Parks and defence land
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## Strategy 3: Enhance protection, improve the quality and increase the extent of habitat suitable for the plains-wanderer.

### Research Actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>3a</b>	Develop strategies and programs to protect and enhance plains-wanderer habitat.	1	<ul style="list-style-type: none"> <li>An ongoing stewardship program is established to support landholders in managing private protected areas to conserve the species, with a focus on habitat quality outcomes.</li> <li>Areas suitable for purchase and management by NGOs and private land conservation bodies are identified.</li> <li>Financial models are identified to support landholders in removing future risks of habitat loss through application of in-perpetuity conservation covenants.</li> <li>Networks of private protected areas are established to complement existing public reserves and create long-term viable habitat areas of 20 000 ha or greater.</li> </ul>	<b>TfN</b> <b>BHA</b> <b>NCT</b> <b>MLLS</b> <b>RLLS</b>	\$100 000 pa <i>(for five year stewardship program to protect twenty farms at \$5000 ea)</i>

### On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>3b</b>	Reduce, and where possible prevent, the clearing and loss of habitat in important areas.	1	<ul style="list-style-type: none"> <li>Current protections of plains-wanderer habitat under the Native Vegetation Act (NSW), and as detailed in the environmental outcomes assessment methodology, are maintained in NSW.</li> </ul>	<b>OEH</b> <b>DELWP</b> <b>PV</b>	Core government business

			<ul style="list-style-type: none"> <li>Current protections of plains-wanderer habitat under native vegetation laws in Victoria and other range states are maintained or strengthened.</li> </ul>		
<b>3c</b>	Remove the threat posed by introduced trees and large boxthorns on, or within 300 m of, red soils providing known habitat for plains-wanderers.	1	<ul style="list-style-type: none"> <li>Introduced trees, and other large trees, that are providing perches for potential predators of plains-wanderers in known habitat for the species are identified.</li> <li>Any large introduced trees that are located in known plains-wanderer habitat and are supporting known predators of the species are removed, or tree limbs that provide perches for predators are lopped.</li> </ul>	<b>DELWP</b> <b>OEH</b> PV TfN MLLS NCCMA RLLS	\$4000 pa

## Strategy 4: Identify key factors contributing to significant recent declines in numbers and develop mitigation measures to address these threats.

### Research Actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>4a</b>	Study the effects of season, grazing and burning on food resource type and availability in suitable habitat.	2	The effects of seasonal variation on plains-wanderer food availability are differentiated in respect to: <ul style="list-style-type: none"> <li>autumn burning regimes;</li> <li>conservative set stocking regimes; and</li> <li>strategic autumn/winter grazing.</li> </ul>	<b>DELWP</b> <b>PV</b> <b>OEH</b> TfN NTAG Research community	-
<b>4b</b>	Assess the impact of wide-spread pesticide use on plains-wanderers.	1	<ul style="list-style-type: none"> <li>Mechanisms are investigated by which to identify, and quantify the scale of, on-ground pesticide application within plains-wanderer habitat.</li> <li>Spatial mapping overlaying all known pesticide applications with mapping of plains-wanderer habitat is produced.</li> <li>Areas in which pesticide use overlaps with plains-wanderer distribution are identified.</li> <li>The effectiveness of spraying exclusion zones around plains-wanderer habitat, as currently applicable at the state/regional level, is evaluated.</li> <li>A research methodology is developed to analyse the potential impacts of pesticide spraying on prey availability.</li> <li>Outcomes of research are communicated to key state agencies.</li> </ul>	<b>DotE</b> Research community	\$10 000

<b>4c</b>	Measure the impacts of feral species, wildfires and quail hunting on plains-wanderers.	2	<ul style="list-style-type: none"> <li>Understanding of the spatial heterogeneity of feral species impacts upon plains-wanderers is increased, with a focus on potential impacts in the species strongholds in the Riverina region of NSW and the Northern Plains of Victoria.</li> <li>Areas in which wildfires pose a threat to key habitat for plains-wanderers are identified.</li> <li>Areas in which quail hunting, including illegal hunting, overlaps with plains-wanderer distribution are identified.</li> </ul>	<b>DELWP</b> <b>OEH</b> DNEWR NPSR GMV PV TfN CFA (Vic) RFS (NSW) MLLS RLLS	-
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## On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>4d</b>	Develop and implement feral species control programs.	2	<ul style="list-style-type: none"> <li>Feral species control programs are implemented, at regional scales (i.e. landscapes &gt; 10 000 ha), with efforts centred on important areas of reserved plains-wanderer habitat (such as Oolambeyan National Park).</li> <li>Control programs take into account the potential synergistic relationships between different feral predators, such as foxes, cats and rats.</li> <li>Feral species numbers are monitored in areas where they have been identified as posing a potential threat to plains-wanderers.</li> </ul>	<b>OEH</b> <b>DELWP</b> <b>PV</b> NCCMA DNEWR NPSR TfN MLLS RLLS	-
<b>4e</b>	Where necessary, mitigate the impacts of wildfires on plains-wanderers.	3	<ul style="list-style-type: none"> <li>Wildfire mitigation and fire suppression activities are implemented, as necessary, to protect habitat critical for the plains-wanderer.</li> <li>Where appropriate, mitigation measures include mechanical reduction of fuel loads.</li> </ul>	<b>DELWP</b> <b>PV</b> <b>OEH</b> CFA (Vic) RFS (NSW)	-
<b>4f</b>	Where necessary, mitigate the impacts of quail hunting on plains-wanderer survival.	3	<ul style="list-style-type: none"> <li>Lost and deteriorated 'No Shooting' signs on farm gates and fences are replaced for interested landholders.</li> <li>The recorded history of quail hunting impacts on plains-wanderers is collated and, if appropriate, a case is developed for excluding quail hunting from key areas of the Northern Plains of Victoria.</li> </ul>	<b>DELWP</b> <b>PV</b> GMV TfN	-

			<ul style="list-style-type: none"> <li>Illegal quail hunting is reduced/stopped in key plains-wanderer habitat.</li> <li>An information flyer on plains-wanderers is developed for incorporation into hunting guides.</li> </ul>		
<b>4g</b>	Where necessary, mitigate the impacts to plains-wanderers from the use of pesticides.	2	<ul style="list-style-type: none"> <li>Protocols for the use of spraying exclusion zones around plains-wanderers and their habitat are maintained or enhanced, if found to be necessary based on the outcomes of action 3b.</li> <li>Any recommended updates to protocols are clearly articulated to key state agencies.</li> <li>A community outreach program is developed to inform relevant landholders about best-practice pest control protocols in the vicinity of plains-wanderer habitat.</li> </ul>	<b>DELWP</b> <b>PV</b> <b>OEH</b> MLLS RLLS TfN	-

## Strategy 5: Improve understanding of the distribution and population trends of the plains-wanderer.

### Research Actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>5a</b>	Increase understanding of population dynamics and ecology of the plains-wanderer (e.g. population size, age/size class structure, dispersal rates, distribution).	2	<ul style="list-style-type: none"> <li>Knowledge on the population dynamics (including recruitment and survivorship in populations) of the plains-wanderer is significantly increased.</li> <li>Measures of current population size and age/class structure are identified and dispersal rates are assessed.</li> <li>Understanding of the plains-wanderers spatial ecology, and preferred floristic habitat attributes, is increased.</li> <li>Genetic material is collected, stored and recorded from plains-wanderers, whenever the opportunity arises.</li> <li>Opportunities to use genetic techniques to analyse plains-wanderer population size and trends have been investigated.</li> <li>Long-term population monitoring results are analysed to determine availability of birds for any captive breeding program, and allow for investigation of causes of decline.</li> </ul>	<b>OEH</b> <b>DELWP</b> PV Research community	-



## On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost <i>*priority 1 only</i>
<b>5b</b>	Implement a long term plains-wanderer monitoring program in the species' strongholds in the Riverina region of NSW and the Northern Plains of Victoria.	1	<ul style="list-style-type: none"> <li>Long-term monitoring grids are established at key sites across the Riverina region in NSW and the Northern Plains region in Victoria.</li> <li>Regular effective monitoring of plains-wanderer populations is conducted at permanent sites, and incorporates measurements of habitat structure, native grass and herb cover.</li> <li>Population trends and habitat suitability are assessed for each site and reported annually to DotE and PwRT.</li> <li>Alternative survey and monitoring techniques are trialled to inform monitoring in other plains-wanderer locations, including assessment of the detectability success of each method.</li> </ul>	<b>OEH</b> <b>DELWP</b> <b>PV</b> NCCMA PwRT TfN	\$30 000 pa
<b>5c</b>	Undertake regular monitoring at other known plains-wanderer sites.	2	<ul style="list-style-type: none"> <li>Targeted surveys are undertaken in suitable habitat in eastern pastoral South Australia to establish whether resident populations exist.</li> <li>Other known and likely habitats are surveyed to locate viable plains-wanderer populations.</li> <li>A regular monitoring program is established for other important plains-wanderer locations (e.g. biennial).</li> <li>Monitoring techniques are informed by the results of trials conducted under action 5b.</li> </ul>	<b>OEH</b> <b>DELWP</b> <b>PV</b> <b>DNEW</b> NPSR PwRT TfN BHA	-

## Strategy 6: Increase community participation in plains-wanderer conservation and management

### Research Actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost *priority 1 only
<b>6a</b>	Develop and implement a broad strategy to raise awareness and educate the general public about plains-wanderer conservation.	2	<ul style="list-style-type: none"> <li>Articles about plains-wanderer conservation, including threats and recovery actions, are published in community newsletters, local bulletins and newspapers.</li> <li>Information displays, and other strategies, are implemented to educate the broader community about plains-wanderer conservation.</li> <li>Information on the plains-wanderer is provided to the birding community.</li> <li>Opportunities for community groups, or citizen scientists, to assist in surveys for plains-wanderers and/or provide data are investigated.</li> </ul>	<b>PwRT</b> <b>PV</b> <b>BirdLife Australia</b> Friends of TTNP BHA TfN DELWP OEH Community groups	-

### On-ground actions

Action	Description	Priority	Performance Criteria	Responsible Agencies and potential partners	Indicative Cost *priority 1 only
<b>6b</b>	Continue to inform, support and encourage landholders and other community members, including Indigenous groups, to be involved in plains-wanderer conservation.	2	<ul style="list-style-type: none"> <li>All landholders with plains-wanderer habitat are aware of the species and its management requirements and have been encouraged to manage their native grasslands for biodiversity outcomes.</li> <li>Locally-based facilitator/s are established to engage with landholders on improved habitat management and delivery of incentive and/or stewardship programs.</li> </ul>	<b>OEH</b> <b>DELWP</b> <b>PV</b> DEWNR DEHP Friends of TTNP Geelong FNC TfN BHA	-
<b>6c</b>	Develop a targeted information pack to assist landholders, outdoor enthusiasts and professionals to identify and report sightings of plains-wanderers.	3	<ul style="list-style-type: none"> <li>An information pack that aids in identification, and provides details of how to report sightings, of plains-wanderers is developed and distributed among landholders and other members of the public that engage in work or recreational activities in known or potential plains-wanderer habitat</li> <li>Reported sightings of plains-wanderers are collated and information disseminated among relevant stakeholders.</li> </ul>	<b>DELWP</b> <b>PV</b> <b>OEH</b> PwRT BirdLife Australia	-

## 8 Duration and cost of recovery process

It is anticipated that the recovery process will not be achieved prior to the scheduled five year review of the recovery plan. The *National Recovery Plan for the Plains-wanderer (Pedionomus torquatus)* will therefore remain in place until such time as the Australian population of the plains-wanderer has improved to the point at which the population no longer meets threatened species status under the EPBC Act.

The cost of implementation of this plan should be incorporated into the core business expenditure of the affected organisations and through additional funds obtained for the explicit purpose of implementing this recovery plan. It is expected that state and Commonwealth agencies will use this plan to prioritise actions to protect the species and enhance its recovery, and that projects will be undertaken according to agency priorities and available resources. Whilst only Priority 1 actions are costed in this recovery plan, this should not deflect from any proposal to undertake Priority 2 or 3 actions. All actions are considered important steps towards ensuring the long-term survival of the species.

**Table 3:** Summary of Priority 1 recovery actions and estimated costs in (\$000's) for the first five years of implementation (these estimated costs do not take into account inflation over time).

Action	Cost					
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Develop a captive breeding strategy for plains-wanderers.	15	-	-	-	-	15
Implement the captive breeding strategy and establish a captive population.	500	500	500	500	500	2500
Study the roles of burning and slashing in maintaining and improving the condition of plains-wanderer habitat in National Parks and Reserves, and other lands managed for conservation.	30	30	30	30	-	120
Facilitate grazing management to soil type and enable landholders to maintain suitable grassland biomass for plains-wanderers on red soils.	80	80	80	80	80	400
Closely monitor grazing impacts on public and private reserves, where grazing regimes are being managed for plains-wanderers, to ensure grassland structure remains within acceptable limits.	100	100	100	100	100	500
Design and implement a management strategy for plains-wanderer habitat in National Parks and Reserves and other lands where plains-wanderers are a management target.	80	-	-	-	-	80
Assess the impact of wide-spread pesticide use on plains-wanderers.	100	-	-	-	-	100
Develop strategies and programs to protect and enhance plains-wanderer habitat.	100	100	100	100	100	500
Remove introduced trees and large boxthorns on, or within 300 m of, red soils where suitable plains-wanderer habitat exists.	4	4	4	4	4	20
Implement a long term plains-wanderer monitoring program in the species two strongholds.	30	30	30	30	30	150
<b>Total</b>	1039	844	844	844	814	4385

## 9 Effects on other native species and biodiversity benefits

Supporting work to improve habitat quality in grassland ecosystems is likely to benefit a range of other grassland species, and thus biodiversity in general, through improving the quality and extent of grassland habitat. Furthermore, the plains-wanderer distribution significantly overlaps with the critically endangered 'Natural Grasslands of the Murray Valley Plains' ecological community, thus efforts to improve habitat quality for the plains-wanderer in this region are likely to have a positive effect on this grassland community.

## 10 Social and economic considerations

The major economic impact of this plan will be on those who require approval to remove or modify plains-wanderer habitat and are prevented from doing so, or are required to modify their proposal by a consent authority. Consent authorities need to consider the impact of proposals on plains-wanderer habitat. Any further loss of native grassland habitat from areas known or likely to contain plains-wanderers is regarded as significant.

Plains-wanderer habitat has been heavily modified through clearing, development, fragmentation and degradation. The more fertile areas have been targeted for agricultural pursuits. Restrictions on further clearing of plains-wanderer habitat will impact on some landowners/managers and developers. These restrictions are not predicted to impact significantly on agricultural industries since the remnants of these grassland communities are generally located on less fertile soils and are, therefore, relatively unattractive for grazing or cropping. There is likely to be greater consideration of impacts from urban development.

In addition, some agricultural businesses may be negatively impacted by having to follow restrictions and regulations on the type of spraying allowed for the control of some insect pest species (e.g., plague locusts). However, these restrictions are currently already in place and this recovery plan does not require a further strengthening of these measures.

The main social benefit of this plan is that it addresses community concerns that further losses or local extinctions of charismatic fauna, or biodiversity in general, be prevented. Recent research indicates that across the Northern Plains Grasslands of Victoria a significant proportion of the population values the plains-wanderer and the species functions as an effective flagship for grassland conservation in this region (Johnstone et al., In Press). Furthermore, bird watching is a major recreational pursuit across Australia. Therefore the conservation of bird communities enhances the lifestyle of Australians and provides eco-tourism opportunities.

## 11 Affected interests

Organisations likely to be affected by the actions proposed in this plan include Australian and state governments agencies, particularly those with environmental, agricultural and forestry concerns; land owners and managers; local Indigenous communities; researchers; tourism operators; conservation groups; wildlife interest groups and proponents of land developments in the vicinity of important plains-wanderer habitat. This list, however, should not be considered exhaustive, as there may be other interest groups that would like to be included in the future or need to be considered when specialised tasks are required in the recovery process.

## 12 Consultation

The draft National Recovery Plan for the Plains-wanderer (*Pedionomus torquatus*) was developed through extensive consultation with a broad range of stakeholders. The consultation process included a workshop in Melbourne that brought together key species experts and conservation managers to categorize ongoing threats to the plains-wanderer, and identify knowledge gaps and potential management options. Workshop participants included representatives from DotE, OEH, DELWP, PV, TfN, BirdLife Australia, natural resource management bodies, zoos, researchers, conservation managers, landholders and local community groups. During the drafting process the Department of the Environment (Cwlth) continued to work closely with key stakeholders.

## 13 Organisations/persons involved in evaluating performance of the plan

This plan should be reviewed no later than five years from when it was endorsed and made publically available. The review will determine the performance of the plan and assess:

- whether the plan continues unchanged, is varied to remove completed actions, or varied to include new conservation priorities, or
- whether a recovery plan is no longer necessary for the species as conservation advice will suffice, or the species is recommended for removal from the threatened species list.

The review will be coordinated by DotE in association with relevant Australian and state government agencies and key stakeholder groups such as non-governmental organisations, local community groups and scientific research organisations.

Key stakeholders who may be involved in the review of the performance of the National Recovery Plan for the Plains-wanderer (*Pedionomus torquatus*) include organisations likely to be affected by the actions proposed in this plan.

### **Australian Government**

Department of the Environment

### **Non-government organisations**

Trust for Nature

Bush Heritage Australia

Conservation and community groups (including Landcare)

Universities and other research organisations

BirdLife Australia

Northern Plains Grassland Technical Advisory Group

Recreational birdwatchers

### **State/territory governments**

Office of Environment and Heritage (NSW)

Department of Environment, Land, Water and Planning (Vic)

Department of Environment and Heritage Protection (Qld)

Department of Environment, Water and Natural Resources (SA)

Department of National Parks, Sports and Racing (Qld)

Parks Victoria (Vic)

Natural resource management bodies

Local government

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