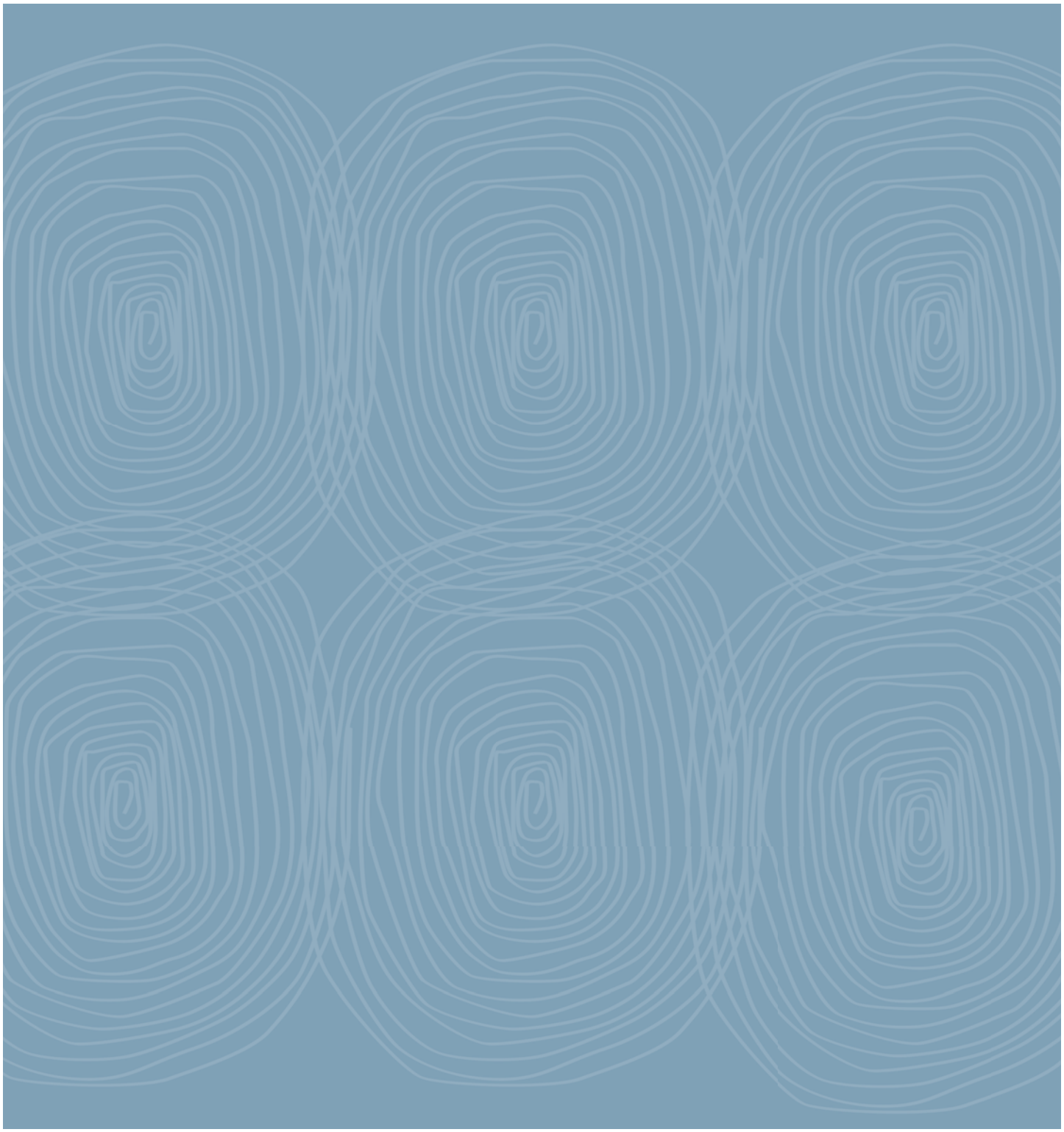
T4.02 Pest and Weed Management Plan



Report

Kevin's Corner Project Pest and Weed Management Plan

SEPTEMBER 2012

Prepared for

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Abbreviations

Abbreviation	Description
AMEC	Association of Mining and Exploration Companies
DAFF	Department of Agriculture, Fisheries and Forestry
EHP	Department of Environment and Heritage Protection
DNRM	Department of Natural Resources and Mines
DNPRSR	Department of National Parks, Recreation, Sport and Racing
DEWS	Department of Energy and Water Supply
DERM	Queensland Department of Environment and Resource Management (reorganised after the March 2012 election to DEPH, DNRM, DNPRSR and DEWS)
DPI	Queensland Department of Primary Industries (Now DAFF)
DEEDI	Queensland Department of Employment, Economic Development and Innovation (reorganised after the March 2012 election to DAFF, DSDIP, DEPH, DNRM, DNPRSR and DEWS)
DNR	Queensland Department of Natural Resources (now DERM)
DSDIP	Department of State Development, Infrastructure and Planning
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
EIS	Environmental Impact Statement
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GIS	Geographical information System
GPS	Global Positioning System
LP Act	Land Protection (Pest and Stock Route Management) Act 2002
NRM	Natural Resource Management
NQ	North Queensland
ROW	Right-of-Way
WONS	Weeds of National Significance
PWMP	Pest and Weed Management Plan

1

Introduction

1.1 Objectives

The purpose of this Pest and Weed Management Plan (PWMP) is to develop effective weed and pest management procedures for the Project area (including off lease road and rail infrastructure areas) and in doing so meet the following objectives:

- Define the weed and pest animal management requirements under current state legislation and local government policies;
- Propose risk assessment tools to be used in assessing weed and pest animal spread into and within the Project area; and
- Propose appropriate procedures to manage weed and pest animal spread into and within the Project area.

1.2 Scope of Work

The scope of work undertaken by URS in developing this PWMP included the following:

- A desktop study including review of:
  - Kevin's Corner Project EIS (URS 2010);
  - Kevin's Corner Project SEIS Section I Off Lease Assessment Report (URS 2012)
  - AMEC Ecological Survey of Off-lease infrastructure (AMEC 2012)
  - Environment Protection and Biodiversity Conservation Act (EPBC) Protected Matters Database (DSEWPaC 2012);
  - Wildlife Online Database (DERM 2011);
  - Information gathered from Weeds of National Significance Weeds (WONS) (Thorp and Lynch 2000);
  - Information gathered from Australian Pest Animal Strategy (Walton 2005);
  - Resource information from the Queensland Government (DPI 2011b);
  - Queensland Government Annual Pest Distribution Maps (DPI 2009); and
  - Local council and NRM group information (NQ Dry Tropics 2009).
- Development of tools including:
  - A GIS map showing possible weed and pest distribution within the area of the Kevin's Corner Project which shall be refined as part of the ongoing monitoring and reporting process; and
  - A Pest and Weed Management Plan for HGPL personnel and contractors working on the Kevin's Corner Project.

Literature Review

2.1 Legislative Context

2.1.1 Commonwealth Requirements

2.1.1.1 Weeds

The Commonwealth Government initiated the National Weeds Strategy in 1997 to coordinate weed management in Australia. A part of this strategy was the identification of Weeds of National Significance (WONS) which was completed in 1999. In April 2012 twelve additional species were added to the WONS list. WONS are based on four criteria:

- Invasiveness;
- Impacts;
- Potential for spread; and
- Socioeconomic and environmental values.

The WONS program agrees upon and manages 20 of Australia's worst invasive weeds (Thorp and Lynch 2000).

Commonwealth legislation (EPBC Act 1999) requires that landowners control any WONS found on their property and take reasonable steps to stop the spread of WONS seeds or propagules from infested areas to non-infested areas.

2.1.1.2 Pest Animals

The focus of the Australian Pest Animal Strategy (Walton 2005) is to address the undesirable impacts caused by exotic vertebrate animals (mammals, birds, reptiles, amphibians and fish) that have become pests in Australia, and to prevent the establishment of new exotic vertebrate pests. It includes 3 goals:

- Provide leadership and coordination for the management of pest animals;
- Prevent establishment of new pest animals; and
- Manage the impacts of established pest animals.

The landowner's responsibility under the strategy is to manage pest animal problems on their own land, and cooperate and, where relevant, plan pest animal management activities jointly with neighbours and local council/government efforts.

The strategy highlights several species as causing impacts to Australia's agriculture and environment. However no specific species list requiring control is given. Control efforts should be aligned with the severity of impact in the landowner's area and those pest animals declared by the state.

2.1.2 State Requirements

2.1.2.1 Weeds

According to the Queensland Government, a weed is a "species that has, or could have, serious economic, environmental or social impacts" (DPI 2011). Plants that do, or have the potential to cause economic, environmental or social impacts in Queensland are declared weeds under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act).

The goals of this Act are to:

- Prevent the introduction and establishment of new pest plants;
- Prevent the spread of pest plants into new areas; and
- Reduce the extent of existing infestations where feasible.

Under the Act, declared weeds are separated into three classes (DPI 2011) as follows:

- A Class 1 declared weed is a pest that has the potential to become a very serious problem in Queensland in the future. All landholders are legally required to keep their land free of Class 1 declared weeds;
- Class 2 declared weeds have already spread across substantial areas of Queensland, but to reduce any further impact, control is needed to avoid further spread of the pest. Landholders are legally required to take reasonable steps to keep their property free from Class 2 declared weeds; and
- A Class 3 declared weed is already established and commonly found in parts of Queensland. Control measures are only required if the weed has the potential to impact local environmentally sensitive areas.

. The state requirements are detailed in the following legislation;

- *Land Protection (Pest and Stock Route Management) Act 2002* (http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/L/LandPrPSRMA02.PDF)
  - Outlines principles for pest management and how these principles should be integrated into State and Local Strategies/Plans;
  - Sets out a process for declaring pests via the regulation; and
  - Provides fact sheet for control strategies. (http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Pest-Strategies-PP60.pdf)
- *Land Protection (Pest and Stock Route Management) Regulation 2003* (http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/L/LandPrPSRMR03.pdf)
  - Outlines declared pests and provides a current listing of all declared weeds and pest animals.
- State weed and pest publications (http://www.dpi.qld.gov.au/4790_9118.htm)
  - Provides links to state documents on specific pests and their control.

2.1.2.2 Pest Animals

Pest animals have significant impacts on Queensland's primary industries, natural ecosystems and human and animal health (DPI 2011a). There are three classes of declared animals under the LP Act. Declaration imposes a legal responsibility for control by all landowners on land under their management, including all landowning state agencies.

- A Class 1 pest is one that is not currently present in Queensland, and if introduced would cause an adverse economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the state. Landowners must take reasonable steps to keep land free of Class 1 pests.
- A Class 2 pest is one that is established in Queensland and has, or could have, a substantial adverse economic, environmental or social impact. The management of these pests requires

coordination and they are subject to local government, community or landowner-led programs. Landowners must take reasonable steps to keep land free of Class 2 pests.

- Class 3 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact. A pest control notice can only be issued for these pests on land that is, or is adjacent to, an environmentally significant area. Thus, the adverse impact of species in this class is primarily environmental.

The state requirements for pest animal control are detailed in the legislation listed above.

2.1.3 Local and Regional Council Requirements

2.1.3.1 Regional

The Kevin's Corner Project site is located within the Burdekin Dry Tropics and therefore is included in the Burdekin Dry Tropics Region Pest Management Strategy. The strategy includes recommendations in line with the LP Act. It also identifies several non-declared weeds as having significant economic, environmental or social impacts at the local scale (NQ Dry Tropics 2009). Of these, noogoora burr (*Xanthium occidentale*) and mimosa bush (*Acacia farnesiana*) were found on site (URS 2010). The Strategy recommends these weeds should be given a high priority in any weed control program.

2.1.3.2 Local

The Kevin's Corner Project site is also located within Barcaldine Shire. The Barcaldine Regional Council has a draft pest management plan currently under review. This plan will be consulted once released for any extra management requirements.

2.2 Database and Literature Searches

2.2.1 Kevin's Corner EIS

Kevin's Corner Project EIS ecology surveys recorded four declared weed species, two weed species identified as a high priority by BDT weed strategy (NQ Dry Tropics 2009), and six declared pest animal species (URS 2010). Table 2-1 shows the species recorded on the Project site

Table 2-1 Kevin's Corner Project EIS Ecology Survey Records

Common Name	Scientific Name	Status
Pest Animals		
feral goat	*Capra hircus*	Class 2 Declared
feral dog	*Canis lupus familiaris*	Class 2 Declared
dingo	*Canis lupus dingo*	Class 2 Declared
feral cat	*Felis catus*	Class 2 Declared
European rabbit	*Oryctolagus cuniculus*	Class 2 Declared

Common Name	Scientific Name	Status
feral pig	*Sus scrofa*	Class 2 Declared
Weeds		
common pest pear	*Opuntia stricta*	Class 2 Declared
velvet tree pear	*Opuntia tomentosa*	Class 2 Declared
rubber vine	*Cryptostegia grandiflora*	Class 2 Declared, WONS
parkinsonia	*Parkinsonia aculeata*	Class 2 Declared, WONS
noogoora burr	*Xanthium occidentale*	Identified by BDT weed strategy*
mimosa bush	*Acacia farnesiana*	Identified by BDT weed strategy*

* NQ Dry Tropics (2009) Burdekin Dry Tropics Region Pest Management Strategy.

2.2.2 AMEC Ecological Survey of Off-lease Infrastructure

In August 2012, AMEC completed a walkthrough ecological survey that included an assessment of weeds for off-lease infrastructure covering the proposed access road and rail spurs. The length of the access road and rail spur were surveyed, with sections of the survey area labelled as follows: (i) North Rail Spur; (ii) Northwest Rail Site; (iii) Road Site 1; (iv) Road Site 2; (iv) Road Site 3; and (v) South Rail Spur (**Figure 2-1**) (AMEC 2012).

The AMEC ecology surveys recorded three declared weed species along the proposed off-lease road and rail alignments (AMEC 2012). **Table 2-2** shows the species recorded on the off-lease infrastructure areas.

Table 2-2 AMEC Ecology Survey Records

Common Name	Scientific Name	Status
Weeds		
common pest pear	*Opuntia stricta*	Class 2 Declared
velvet tree pear	*Opuntia tomentosa*	Class 2 Declared
westwood pear	*Opuntia streptacantha*	Class 2 Declared

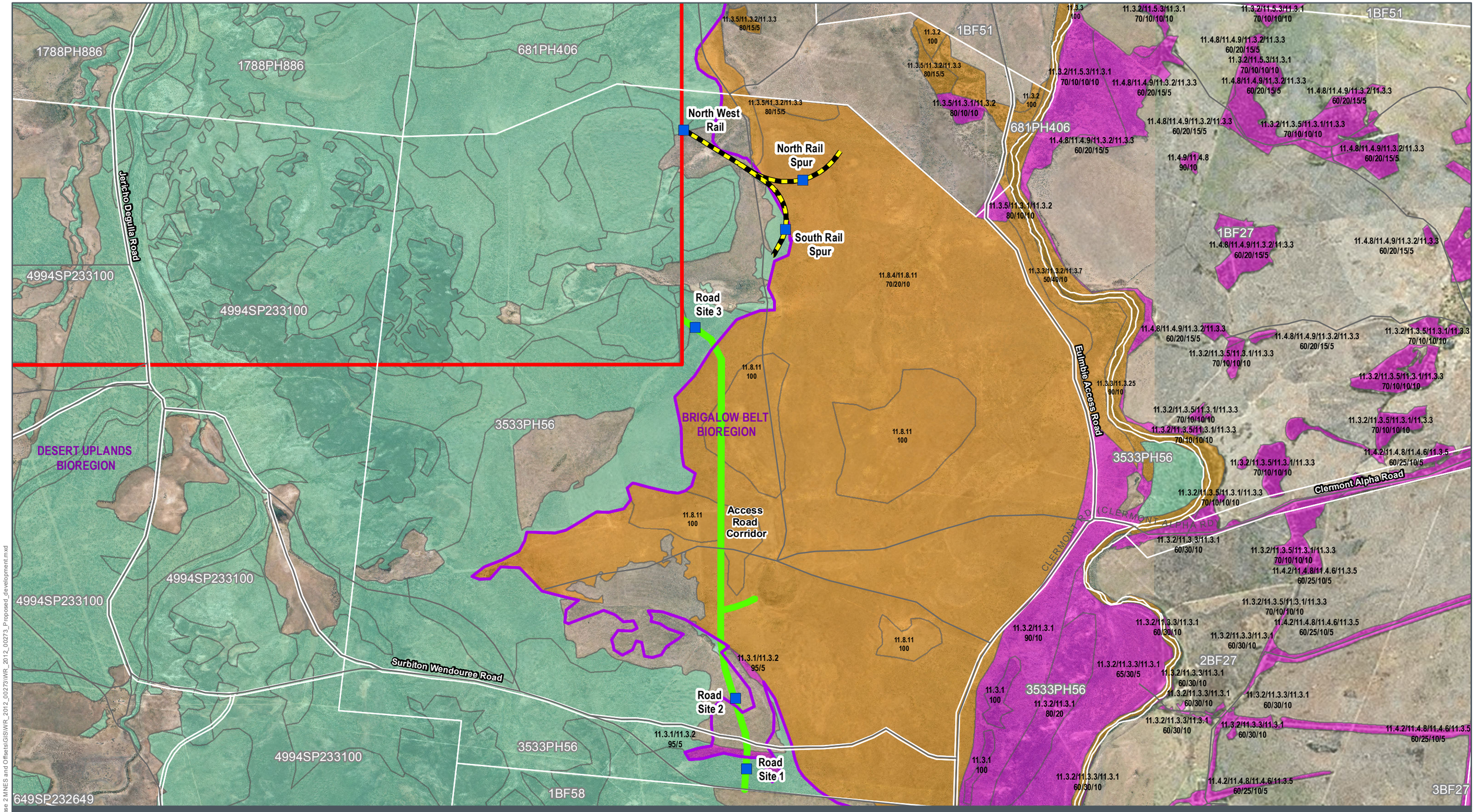

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Figure 2 - 1
Regional Ecosystems

DATE	AUTHOR	APPROVED	REVISION NOTE	REV.
12/09/2012	SN	JC	Issued for Review	A
13/09/2012	TOD	BE	Issued for Use	0

WORK REQUEST NUMBER: WR_2012_00273

DATA SOURCES:
Physical Road Network, Cadastre, Regional Ecosystems (Off Lease), Mining Lease © State of Queensland 2012
Bing © MapData Sciences Australia 2010
Survey Sites © AMEC E&I

HANCOCK GALILEE PTY LTD

amec

0 1 2 3 4 5
Kilometres

1:75,000 (A3) GCS GDA 1994

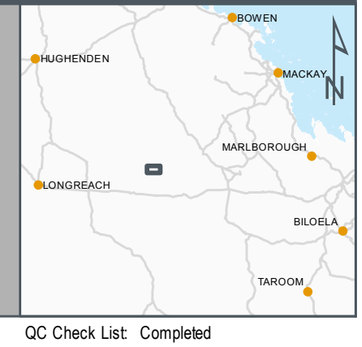
LEGEND

- Off-lease Survey Site
- Road/Track Network
- Proposed Rail Loop
- Access Road Corridor
- Mining Lease ML70425
- Cadastre
- Bioregion

Regional Ecosystems

- Contains Endangered Regional Ecosystem
- Contains Of Concern Regional Ecosystem
- Is a Least Concern Regional Ecosystem

LOCATION DIAGRAM



QC Check List: Completed

Path: P:\Clients - Projects\Hancock Coal\HAN003- Kevin's Corner - Phase 2 MNES and Offsets\GIS\WR_2012_00273\WR_2012_00273_Proposed_development.mxd

2.2.3 Database Search Results

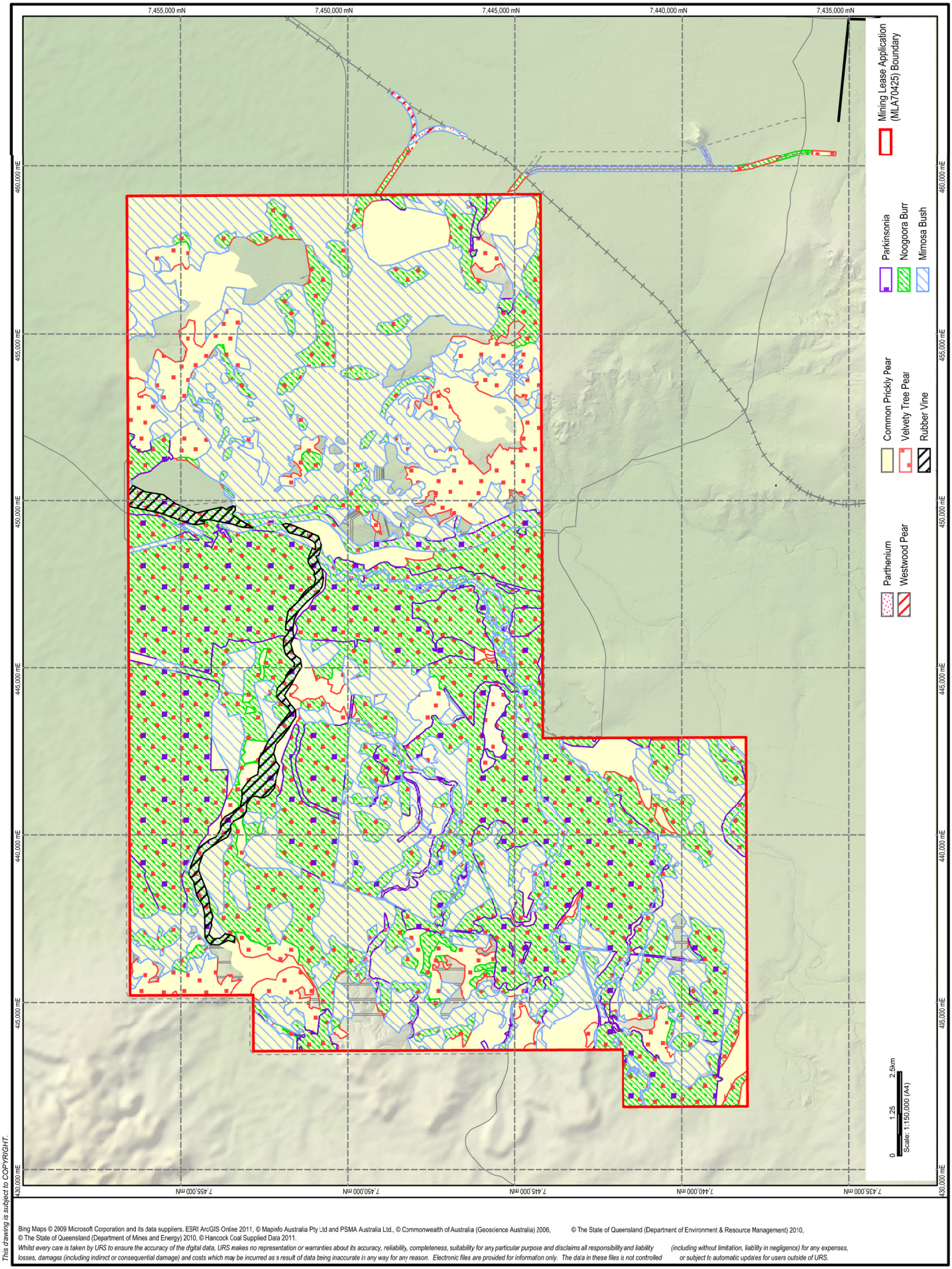
The EPBC protected matters database was searched for weeds and pests likely to occur on the Project site. The Wildlife Online database was searched for records of weeds and pests previously found within the vicinity of the Project site. **Table 2-3** shows the species possibly present on the Project site (including off lease infrastructure areas).

Table 2-3 Database Search Results

Common Name	Scientific Name	Status	Project Site Database Results	Off Lease Database Results
Pest Animals				
red fox	*Vulpes vulpes*	Class 2 Declared	EPBC protected matters	EPBC protected matters
feral cat	*Felis catus*	Class 2 Declared	EPBC protected matters	EPBC protected matters
European rabbit	*Oryctolagus cuniculus*	Class 2 Declared	EPBC protected matters Wildlife Online	EPBC protected matters
feral pig	*Sus scrofa*	Class 2 Declared	EPBC protected matters Wildlife Online	EPBC protected matters
Weeds				
common pest pear	*Opuntia stricta*	Class 2 Declared	Wildlife Online	-
velvet tree pear	*Opuntia tomentosa*	Class 2 Declared	Wildlife Online	-
rubber vine	*Cryptostegia grandiflora*	Class 2 Declared, WONS	EPBC protected matters	EPBC protected matters
parkinsonia	*Parkinsonia aculeata*	Class 2 Declared, WONS	EPBC protected matters	EPBC protected matters
lantana	*Lantana camara*	Class 3 Declared, WONS	EPBC protected matters Wildlife Online	EPBC protected matters
parthenium	*Parthenium hysterophorus*	Class 2 Declared, WONS	EPBC protected matters	EPBC protected matters

2.2.4 Current Weed and Pest Animal Mapping

Current weed mapping was sourced from the Kevin's Corner EIS, the AMEC ecology survey and Queensland government mapping. It shows the areas that have the potential to contain weeds given the data available. The weed data collected for the Kevin's Corner Project EIS was reported by the vegetation communities in which the weed was located. Pest fauna mapping was not carried out as part of the EIS. **Figure 2-2 a & b** shows the weed mapping for the Kevin's Corner Project area and the off-lease infrastructure areas. This map should be added to through yearly monitoring by the HGPL environment officers or external contractors and information gathered from opportunistic sightings by site personnel. This map and the maps available through the Queensland government website (DPI 2009) (These maps should provide a basis for the risk assessment described in **Section 4.2**.)



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Kevin's Corner Project
Supplementary Environmental Impact Statement

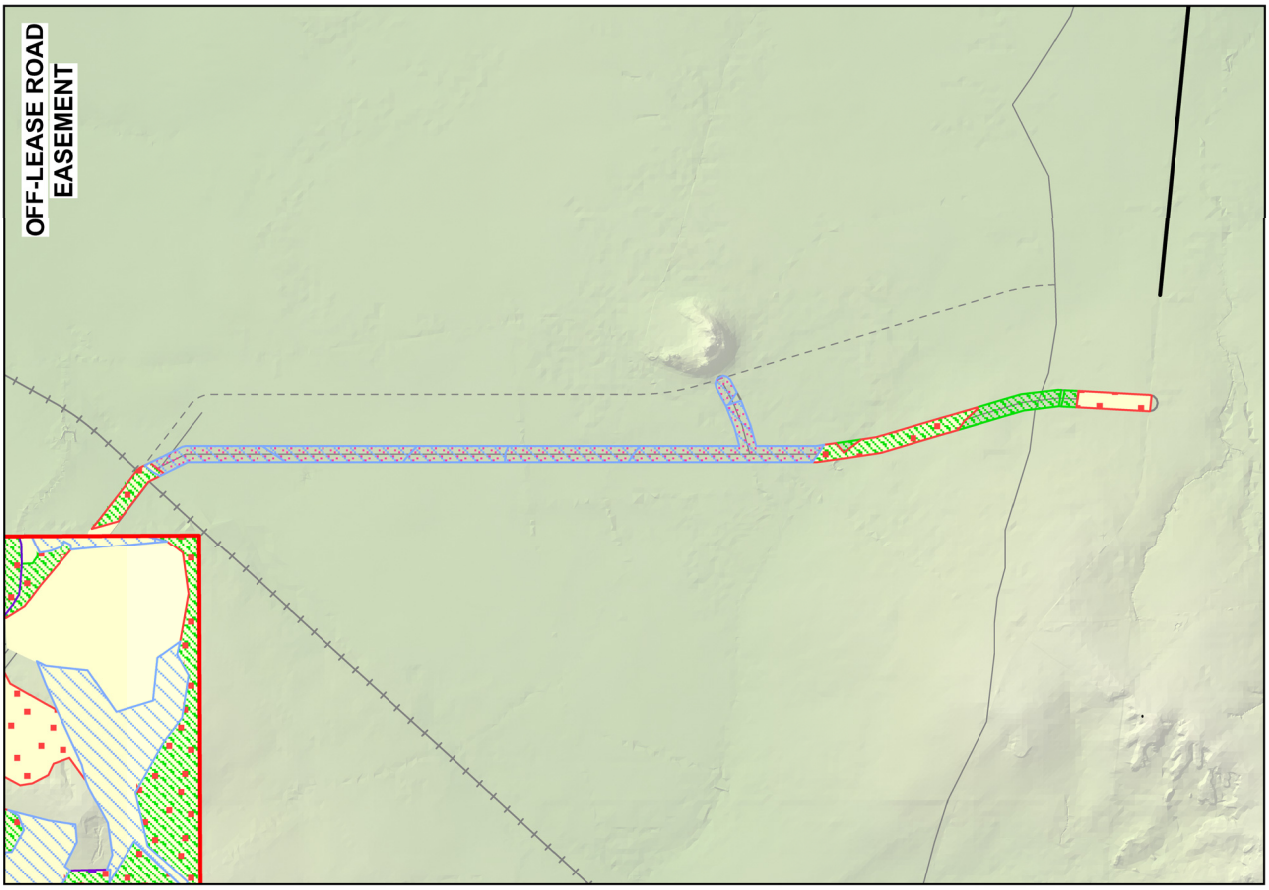
POTENTIAL WEED LOCATIONS BASED ON REGIONAL ECOSYSTEM

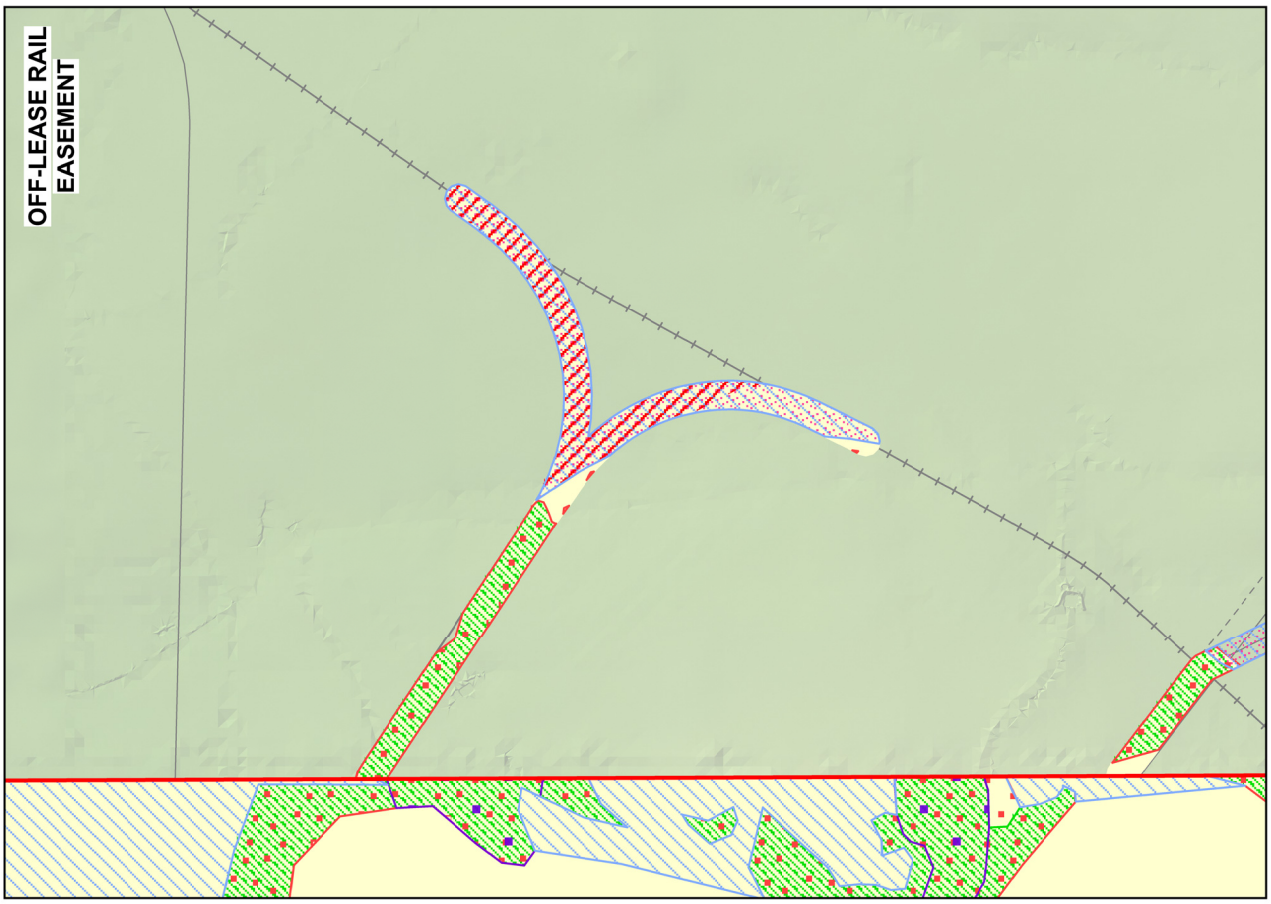
URS

WEED AND PEST MANAGEMENT PLAN

Figure: 2-2a

File No: 42626920-g-2062.wor | Drawn: XL | Approved: RS | Date: 28-08-2012 | Rev: B | A4





Mining Lease Application (MLA70425) Boundary

Parkinsonia
Noogoora Burr
Mimosa Bush

Common Prickly Pear
Velvety Tree Pear
Rubber Vine

Parthenium
Westwood Pear

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Kevin's Corner Project
Supplementary Environmental Impact Statement

POTENTIAL WEED LOCATIONS: OFF-LEASE RAIL AND ROAD

URS

WEED AND PEST MANAGEMENT PLAN

Figure: 2-2b

File No: 42626920-g-2124.wor | Drawn: XL | Approved: RS | Date: 10-09-2012 | Rev: A | A4

Weed and Pest Distribution and Control

3.1 Weeds and Pests Recorded on Site

Four declared weed species and six declared pest animal species were recorded on site during the ecology surveys (URS 2010). This includes the weeds common pest pear, velvety tree pear, rubber vine and parkinsonia; and the declared pest animal species, feral goats, feral dogs, dingos, rabbits and feral pigs as well as mosquitos.

The AMEC ecology survey recorded the common pest pear, velvety pear and westwood pear along the proposed off-lease road and rail alignments (AMEC 2012).

3.1.1 Weeds

3.1.1.1 Common Pest Pear

The common pest pear (*Opuntia stricta*) is one of a number of cacti collectively called “prickly pear”. The prickly pear term includes species of *Opuntia*, *Nopalea* and *Acanthocereus*. In terms of distribution, *O. stricta* occurs throughout most of central and southern Queensland and is spreading westwards. It is found in small to large clumps of varying density. It is a bushy spreading plant up to 1.5 m in height with stems dividing in oval, blue-green pads. Flowers are bright lemon yellow and green at the base with an oval shaped, purple fruit. The common pest pear is best controlled with biological agents (DPI 2011b). Control recommendation can be found in **Appendix A.1**. Although common, common pest pear is not spread by vehicles. The use of wash-down for this species is not required unless vehicles drive directly over the cactus and parts of it become trapped in the vehicle under body.

It was noted that common pest pear was well established on the Project site and was identified within the brigalow (*Acacia harpophylla*) open woodland, silver-leaved ironbark (*Eucalyptus melanophloia*) open woodland, poplar box (*Eucalyptus populnea*) open woodland, fringing riparian woodland, White cypress pine (*Callitris glaucophylla*) woodland, silver-leaved ironbark / poplar box mixed woodland, non-remnant grassland, lancewood (*Acacia shirleyi*) woodland, gidgee (*Acacia cambagei*) open woodland, and Queensland yellowjacket (*Eucalyptus similis*) low open woodland (URS 2010).

AMEC’s survey of off-lease areas (AMEC 2012) found that common pest pear was present but uncommon (representing significantly less than 5% cover) in the North Rail Spur, Northwest Rail Site, Road Site 3 and the Southern Rail Spur survey sites. This species was not recorded at Road Sites 1 and 2.

3.1.1.2 Velvety Tree Pear

The velvety tree pear (*Opuntia tomentosa*) is another of the cacti collectively called “prickly pear”. *Opuntia tomentosa* is found predominantly throughout the Brigalow Belt of Queensland and is still extending its range. It is occasionally found as dense shrubs, but more usually as small clumps of trees or as trees scattered over the landscape. It is a tree-like plant that forms a central woody trunk. Stems dividing into oblong pads are velvety to touch due to the dense covering of short fine hairs. Flowers are deep orange and contain deep red, egg-shaped fruit. The velvety tree pear is best controlled with biological agents (DPI 2011b). Control recommendation can be found in **Appendix A.1**. The use of wash-down for this species is not required unless vehicles drive directly over the cactus and parts of it become trapped in the vehicle under body.

Velvety tree pear has become established within the following communities on the Project site: brigalow open woodland; poplar box open woodland; silver-leaved ironbark / poplar box mixed woodland; non-remnant grassland; gidgee (*Acacia cambagei*) open woodland; fringing riparian woodland; and lancewood woodland (URS 2010).

AMEC's survey of the off-lease areas (AMEC 2012) found that velvety tree pear was abundant (with cover approaching 60%) at Road Site 1, but was absent from all other off-lease survey areas.

3.1.1.3 Westwood Pear

The westwood pear (*Opuntia streptacantha*) is another of the cacti collectively called "prickly pear". *O. streptacantha* is found in central eastern Queensland as small clumps or as plants scattered across the landscape. It is usually 2 to 4 m tall, with stems divided into almost circular dull green pads 25 to 30 cm long and 15 to 20 cm wide. The flowers are yellow and barrel shaped, and the fruit has a purple skin. The westwood pear is best controlled with biological agents (DPI 2011b). Control recommendation can be found in **Appendix A.1**. The use of wash-down for this species is not required unless vehicles drive directly over the cactus and parts of it become trapped in the vehicle under body.

AMEC's survey of the off-lease areas (AMEC 2012) found that westwood pear was present but uncommon (representing significantly less than 5% cover) in the North Rail Spur. It was not found in any other off-lease areas.

Westwood pear was not recorded within the Project area (MLA only) (URS 2010).

3.1.1.4 Rubber Vine

Rubber vine (*Cryptostegia grandiflora*) is a vigorous climber with twining, whip-like shoots. It can climb up to 30 m high trees. The plant can grow unsupported as an untidy shrub with many stems to 1 to 2 m. Rubber vine invades waterways, smothers riparian vegetation and forms dense thickets. This decreases biodiversity and impedes stock and native animal movement. Infestations expand outward from waterways onto hillsides and pastures. Stems, leaves and unripe pods exude a white, milky sap when broken or cut. The flowers are large and showy with five white to light purple petals arranged in a funnel shape. Control of rubber vine can be achieved by a number of methods. The most important aspect of rubber vine control is follow up checks and treatment of any regrowth (DPI 2011b). Control recommendation can be found in **Appendix A.2**.

Rubber vine spreads in two ways; by flotation of pods during flood or in waterways and by wind. If there is no flood the pods do not travel far from the parent plant. However wind is the primary mechanism for spreading seed. Although 85 - 90% of seed lands close to the parent plant, some may be spread significant distances by storms. Wash-down will be required for vehicles working close to infestations of rubber vine or in any areas recently affected by flooding.

Rubber vine was recorded in the *Eucalyptus camaldulensis* fringing riparian woodland (RE 10.3.13a) along Well Creek and Sandy Creek on the Project site (URS 2010).

3.1.1.5 Parkinsonia

Parkinsonia (*Parkinsonia aculeata*) can grow to 8 m in height, although smaller plants are more common. It can be single-stemmed or multi-stemmed with flat leaves and a green leaf stalk. Seed pods are straight with bulges around seeds and points on both ends and generally contain 1 – 4

seeds. Flowers consist of four yellow petals and one erect orange or orange spotted petal. Control of Parkinsonia can be mechanical, chemical or biological depending on the location of the infestation (DPI 2011b). Control recommendation can be found in **Appendix A.3**.

Approximately 90% of parkinsonia seed dispersal is by water, especially during floods. Seeds can be distributed, though rarely, through mud sticking to animals, footwear and machinery and by animals (goats) and birds eating and passing seeds. Wash-down will be required for vehicles working close to infestations of parkinsonia or in any areas recently affected by flooding.

Parkinsonia was discovered on the Project site within the white cypress pine, fringing riparian woodland and non-remnant grassland communities (URS 2010).

3.1.1.6 Noogoora Burr

Noogoora burr (*Xanthium occidentale*) is annual herb to 2.5 (rarely to 4) m high. It forms dense clumps that can exclude animals from water. It also competes with pasture and summer crops. Its stems are rough to touch and are usually blotched or streaked purple. Leaves are dark green above, paler below, ovate or triangular 5–15 cm long with 3 or 5 lobes. Brown burrs each contain two brown, grey or black seeds (DPI 2011b).

Noogoora burr is not a declared weed and as such there is no legal requirement to control it. However, the regional NQ Dry Tropics NRM group has identified this weed through its weed management strategy as having significant impact locally (NQ Dry Tropics 2009). They recommend that it is given a high priority in any weed management plan. Control recommendations can be found in **Appendix A.5**.

The seeds of noogoora burr are transported in burrs. Burrs are spread attached to animals, clothing and machinery. Burrs also float and are moved by water which is why most noogoora burr infestations occur along waterways (DPI 2011b). Wash-down will be required for vehicles working in muddy conditions close to infestations of noogoora burr, in areas frequented by stock or in any areas recently affected by flooding. In dry conditions the vehicle should be inspected to determine if a wash-down is necessary.

Noogoora burr was found in poplar box woodland, fringing riparian woodland and non-remnant grassland (URS 2010).

3.1.1.7 Mimosa Bush

Mimosa bush (*Acacia farnesiana*) is a rounded shrub or small tree that may be confused with the declared weeds mesquite (*Prosopis* spp.) and prickly acacia (*Acacia nilotica*). It is a fast spreading weed that can form thorny thickets which may hinder wildlife and stock access to water. Mimosa bush grows to about 3 m, occasionally to 5 m and has branches that grow in a zigzag shape. Its leaves are ferny with thorns found in pairs at the base of each leaf. Flowers are ball-shaped and golden yellow (DPI 2011b).

Mimosa bush is not a declared weed and as such there is no legal requirement to control it. However, the regional NQ Dry Tropics NRM group has identified this weed as having significant impact locally. They recommend that it is given a high priority in any weed management plan (NQ Dry Tropics 2009). Control recommendation can be found in **Appendix A.6**.

Hairs on the pod segments allow them to float on water and stick to hair or clothing, hence aiding in dispersal. Mimosa bush is therefore commonly found along waterways frequented by stock and around watering points (DPI 2011b). Wash-down will be required for vehicles working close to infestations of mimosa bush, in areas frequented by stock or in any areas recently affected by flooding.

Mimosa bush was found in silver-leaved ironbark woodland, fringing riparian woodland, and in the EPBC listed threatened ecological community *Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* (URS 2010). This weed is most likely to have an impact in the natural grasslands as it has no competition for sunlight from other bushes or trees.

3.1.2 Pest Animals

3.1.2.1 European Rabbit

European rabbits (*Oryctolagus cuniculus*) are a major agricultural and environmental pest in Australia. They compete for food with native animals, are a leading cause of soil loss and can contribute to the silting up of aquatic ecosystems (DPI 2011b). Favourable habitat conditions and food availability are likely reasons behind their prevalence throughout the Project site where they were observed in abundance (URS 2010).

Control methods include destroying rabbit warrens, baiting, rabbit-proof fencing, and fumigation, trapping and shooting. Biological control such as Myxomatosis and Rabbit Haemorrhagic Disease can also be effective. Specific information on control can be found in **Appendix A.7** and at the Queensland government web site (DPI 2011c).

3.1.2.2 Wild Dogs

The term wild dog refers collectively to purebred dingoes (*Canis familiaris dingo*), dingo hybrids, and domestic dogs (*Canis familiaris*) that have escaped or been deliberately released. Impacts caused by wild dogs include predation of livestock and native animals and spread of disease (DPI 2011b).

Specific information on control can be found in **Appendix A.8** and at the Queensland government web site (DPI 2011c). In addition, there is also the Wild Dog Management Strategy. This strategy is a result of an extensive review by Queensland Dog Offensive Group in conjunction of various comments and recommendations received from key stakeholders, government agencies and animal groups. It is available from the Wild Dog Management Strategy 2011-16 website (DEEDI 2011).

3.1.2.3 Feral Cat

Feral cats are defined as those living without human assistance and do not include semi-feral cats, which live around dump sites, alleys or abandoned buildings, relying on humans by scavenging rubbish scraps. Feral cats are opportunistic predator of small mammals, birds, reptiles, amphibians, insects and even fish. They compete for prey with native predatory species such as quolls, raptors and reptiles. Feral cats also contain a parasite that is particularly harmful to marsupials, causing blindness, respiratory disorders, paralysis, and loss of offspring (DPI 2011b).

The Commonwealth Government has developed a threat abatement plan for feral cats which can be found on their website (DEWHA 2008). Trapping and fencing are the most effective way to control feral cats. Specific information on control is presented in **Appendix A.9.**

3.1.2.4 Feral Pig

The feral pig (*Sus scrofa*) is one of the most widespread and damaging pest animals in Queensland. They favour environments with permanent water bodies and have the potential to cause widespread ecological damage by spreading weeds and disease and spoiling riparian areas (DPI 2011b). Feral pigs were observed by stock watering dams located in non-remnant grasslands and in watercourses on the Project site (URS 2010).

Control methods may include trapping, fencing and possibly poisoning treatments (DPI 2011b). Specific information on control can be found in **Appendix A.10** and at the Queensland government web site (DPI 2011c).

3.1.2.5 Feral Goat

Feral goats are widespread throughout Australia with approximately 10% of the population living in Queensland. Some of the environmental impacts caused by feral goat populations include overgrazing, increased soils erosion and land degradation. Their selective feeding can alter the floristic composition of plant communities and lead to reduced species diversity as preferred plants can be lost from communities in relatively short periods (DPI 2011b).

Trapping and shooting are the preferred control methods for feral goats. Specific information on control can be found in **Appendix A.11** and at the Queensland government web site (DPI 2011c).

3.1.2.6 Mosquitoes

Mosquitoes are native insects that breed in salt, brackish or fresh water. Larvae of mosquitoes can be an important food source for aquatic animals. Mosquitoes contribute to the biological diversity of natural areas. More than 220 mosquito species can be found in Queensland. A substantial number of these have been implicated as vectors of some human diseases.

Direct control of mosquitoes can be undertaken by habitat modification, biological control, or in some cases, by the use of approved chemicals. Indirect control can be achieved by appropriate planning to restrict development near or downwind of mosquito breeding sites, building appropriate accommodation, using insect screens, air conditioning, protective clothing and personal repellents and avoiding areas at certain times of the day or year when biting insects are likely to be a problem. Personal protective measures can be the most effective way to prevent the spread of vector-borne diseases. Specific information on control can be found in **Appendix A.13** and at the Queensland government web site (Health QLD 2002a and DERM 2011a).

3.2 Weeds and Pests Found in Databases Searches

Six declared weed species were reported in the databases as potentially present, including common pest pear, velvet tree pear, rubber vine, parkinsonia, lantana and parthenium. Lantana and parthenium were not recorded during the EIS surveys (URS 2010). Westwood pear was additionally recorded by the AMEC survey.

Off lease areas contain large areas of EPBC TEC Natural Grasslands (SEIS Appendix I Section 2.4.1). Surveys conducted in off-lease areas (AMEC 2012) confirmed the presence of the Natural Grasslands TEC along the North Rail Spur and Road Site 2 transects (**Figure 2-1**). No parthenium was recorded by AMEC within their survey sites or while traveling between the sites.

Four declared pest animal species were reported in the databases as likely to be present, feral cat, rabbits, feral pigs and red fox. The red fox was not recorded during the EIS surveys (URS 2010). These additional species are described below.

3.2.1 Weeds

3.2.1.1 Parthenium

Parthenium weed (*Parthenium hysterophorus*) is an annual herb with a deep taproot and an erect stem that becomes woody with age. It invades pastures, disturbed bare areas along roadsides, heavily stocked areas around yards and watering points. It impacts stock production and cropping industries. Its pollen contains potent allergens that can cause reactions such as dermatitis and hay fever. Parthenium grows to 1-1.5 m in height, developing many branches in its top half when mature. It has pale-green leaves, deeply lobed and covered with fine soft hairs and small creamy white flowers on stem tips (DIP 2011b).

Parthenium seed is spread easily by wind, water, farm and industrial machinery, feral animals, humans, vehicles, stock fodder and movement of stock, grain and hay. Due to its ease of spread wash-down protocols are extremely important in areas of parthenium infestation. Wash-down will be required after working in areas known to have had parthenium even if the weed is not currently seen. Parthenium seed may lay dormant in the soil for 2-6 years (DPI 2001). Vehicles will require an inspection and possible wash-down if working in wet and windy conditions in parthenium areas even if the vehicle did not leave the tarmac.

Parthenium was not seen on site during the EIS survey (URS 2010), nor was it located in the off lease areas (AMEC 2012). However it has been identified as potentially present from database searches (DSEWPaC 2012). In order to minimise incursion of parthenium into the areas of Natural Grassland TEC (Figure 2-1), it is recommended that areas of ground disturbance be closely monitored for the emergence of parthenium. Parthenium control should be a management priority in these areas.

Should parthenium need to be controlled on site a combined approach of different control methods including chemical, biological, mechanical and herbicide integrated with land management practices is most effective. Vehicle hygiene and wash-down procedures are particularly effective in managing the spread of this weed (DPI 2011b). Control recommendation can be found in **Appendix A.4**.

3.2.1.2 Lantana

Lantana (*Lantana camara*) is a heavily branched shrub that can grow as compact clumps, dense thickets and as scrambling and climbing vines. It forms dense thickets that can smother native vegetation. The thickets are impenetrable for larger animals, people and vehicles. It is spread mostly by people and fruit-eating birds. The stems are square with small, recurved prickles. The leaves are bright green, about 6 cm long, with round toothed edges and grow opposite one another along the stem. Flowers vary in colour from pale cream to yellow, white, pink, orange, red, lilac and purple, and the fruits are glossy, rounded, and purplish-black when ripe (DPI 2011b).

Fruit eating birds are the main cause of lantana spread but can also be spread by water, contaminated soil and machinery. Lantana can also spread vegetatively. Horizontal stems are able to take root when they contact moist soil. Wash-down will be required for vehicles working close to infestations of lantana (DPI 2011b).

As a Class 3 declared weed, control of lantana is only required if it is threatening to invade an area of environmental significance. Lantana was not seen on site but has been identified as potentially present from database searches (DSEWPaC 2012, DERM 2011). Should lantana need to be controlled on site information can be found at http://www.dpi.qld.gov.au/4790_7309.htm.

3.2.2 Pest Animals

3.2.2.1 Red Fox

The European red fox (*Vulpes vulpes*) predates livestock and native species and is considered the greatest threat to the long-term survival of many small marsupial species in Australia. Different control methods including shooting, poisoning, trapping, guard animals and fencing along with land management practices are the most effective. Toxin ejectors and fertility control such as immunocontraception are also being researched (DPI 2011b). Specific information on control can be found in **Appendix A.12** and at the Queensland government web site (DPI 2011c).

Management Plan

This PWMP outlines procedures to prevent the further spread of weeds by assisting field personnel in undertaking:

- Weed Identification;
- Risk Analysis and Planning;
- Access Procedures;
- Wash-down Procedures; and
- Compliance Checks.

The following sections provide details on how each of the above goals shall be achieved:

4.1 Weed Identification

Weed Identification	
Goal	To identify declared weeds, WONS and pest animals in the Project area (including off lease infrastructure areas) and on road-sides leading up to the Project area.
Outcome	To prepare and regularly update a GIS map with areas of known and potential weed and pest infestations within the Project area.
Actions	• Provide training to relevant field personnel (**Section 4.7**); • Produce a weed ID brochure or poster of the weeds listed in section 3 to be displayed in prominent locations • Target inspection times for periods of potential high weed growth risk (e.g. after high or seasonal rainfall periods); • Liaise with local government and neighbouring landholders for weed and pest data sets and updated information about newly infested areas; and • Maintain and update the GIS weed map.
Performance Indicators	Accurate weed identification
Monitoring, Reporting & Corrective Actions	• Weed infestation sightings by personnel to be reported to HGPL environment officers for investigation; • Survey of weed prone areas to be conducted annually after wet season rainfall events (November – March); • Data to be forwarded to HGPL environment officers for inclusion in the weed data sets and mapping; and • Where weed infestation has been identified, initiate appropriate management controls.
Responsible Persons	Refer to **Section 4.6**.
Associated Documentation	Weed and Pest Animal Identification and control information in **Appendix A**.

The goal of weed and pest identification is that all personnel are able to positively identify weeds or pest of significance. This information will be relayed back to the environment officer to add to the GIS weed map and give more specific weed locations.

If a plant is believed to be a weed, but the identifier is uncertain, photographic evidence should be taken and then if needed positive identification by the HGPL environment officers.

If a pest animal is seen it should be reported to the site environment officer with a location. If possible a photo should be taken to aid positive identification.

4.2 Risk Analysis and Planning

Risk Analysis and Planning	
Goal	Review risk the of weed spread and plan control measures.
Outcomes	• Ensure risk analysis procedures and planning are carried out following identification of weed infestations **(Section 4.1)**; • Ensure access is controlled in areas identified as containing weeds; and • Ensure appropriate wash-down procedures are selected.
Actions	• Assess potential risk factors using Vehicle/Machinery Wash-down Risk Assessments **(Figure 4-1)** and Cargo Risk Assessments **(Figure 4-2)**; • Limit contamination of areas external to the project area, and ensure proper wash-down procedures are complied with; • Nominate appropriate wash-down facility (permanent or temporary) locations; • Complete Weed Hygiene Declaration Form if required (refer **Appendix B.2)**; and • Identify and construct any additional wash-down facilities as required (**Section 4.4.4**).
Performance Indicators	• Approved weed wash-down facilities are identified; and • Most recent weed survey reviewed. Wash-down facilities and access routes revised appropriately.
Monitoring, Reporting & Corrective Actions	In accordance with **Section 4.8** of this PWMP.
Responsible Persons	Refer to **Section 4.6.**
Associated Documentation	• Updated GIS weed and pest map; • Vehicle/Machinery Wash-down Risk Assessment flow chart (**Figure 4-1**); • Cargo Wash-down Risk Assessment flow chart **(Figure 4-2);** and • Hygiene Declaration Form (refer **Appendix B.2)**.

4.2.1 Personnel, Vehicle and Machinery Risk Assessment

The basis of the personnel, vehicle and machinery risk assessment is the likelihood of contact with WONS, declared weeds or weeds of local significance which can be associated with activities such as driving off formed roads or driving or working in wet and windy conditions. A flow chart has been designed to assess the risk of vehicles or machinery coming in contact with weeds seeds or propagules and therefore requiring wash-down and inspection prior to leaving or entering the Project area (including off lease infrastructure areas) (**Figure 4-1**).

When assessing the risk of contact with weed propagules the following questions should be considered;

- Will the work involve leaving the tarmac in a known weed infested area (off tarmac includes dirt roads and farm tracks)?
- Will the work involve driving on a muddy road or track in an area of unknown weed status or weed infested status?
- Will the work involve leaving a track of any kind and driving through an area with unknown weed status?

- Will the work involve leaving the vehicle and working in a known weed infested area, in an area where weed may be observed, or in a muddy or wet area?

These questions will help follow the flow chart in **Figure 4-1**. Driving on dirt roads and farm tracks does not necessitate a wash-down except in muddy conditions, where weeds are observed, or where it is a known weed infested area. In the case of dirt road and farm track driving in a dry, weed free or weed status unknown area, an inspection is required but will only progress to a wash-down if soil, plant material or seeds are found on the vehicle.

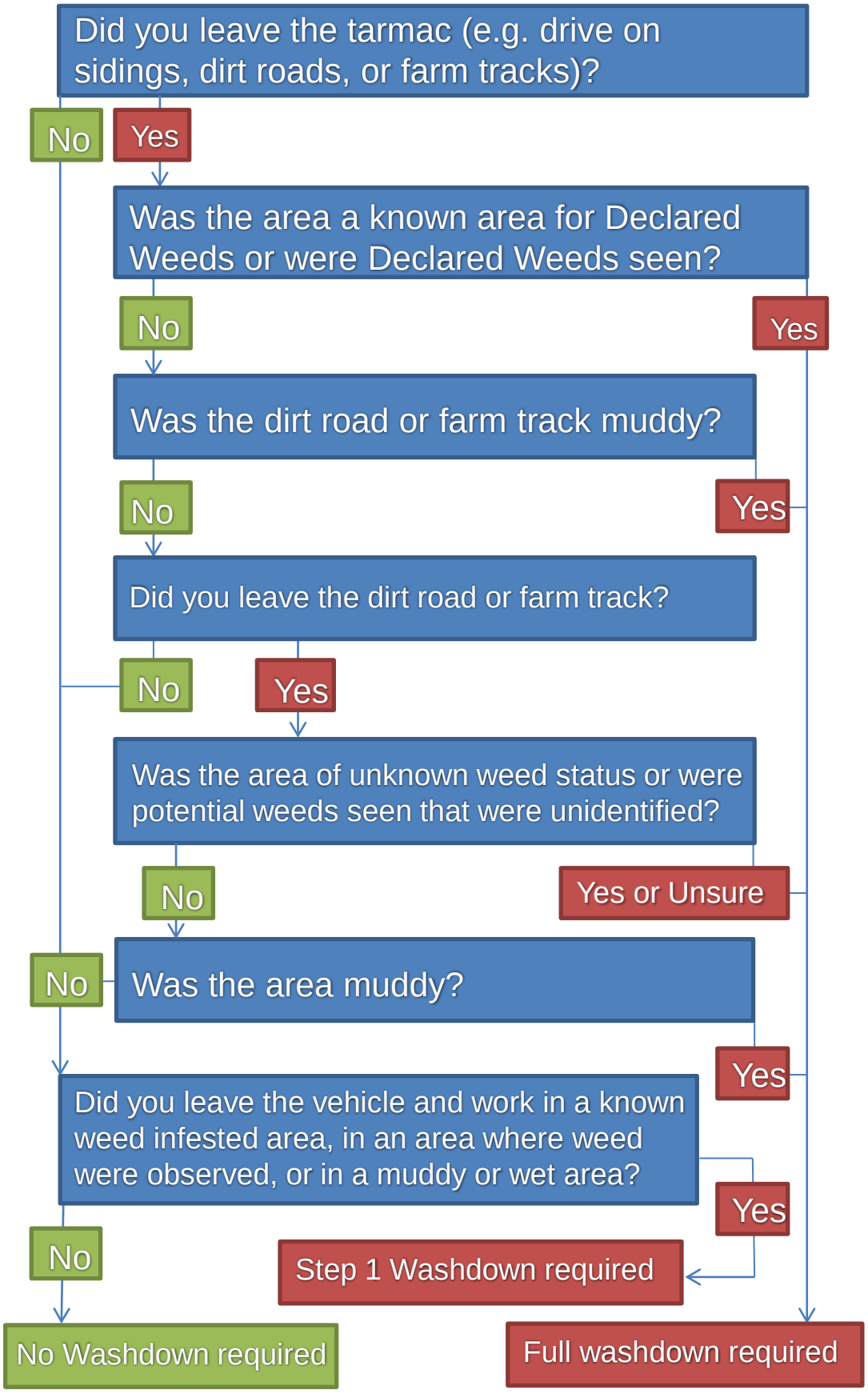
If the work involves leaving the vehicle and working in a known weed infested area, in an area where weed were observed, or in a muddy or wet area an internal clean of the vehicle and a shakedown of personnel will be required (Step 1 of the weed wash down checklist in **Appendix B.1**).

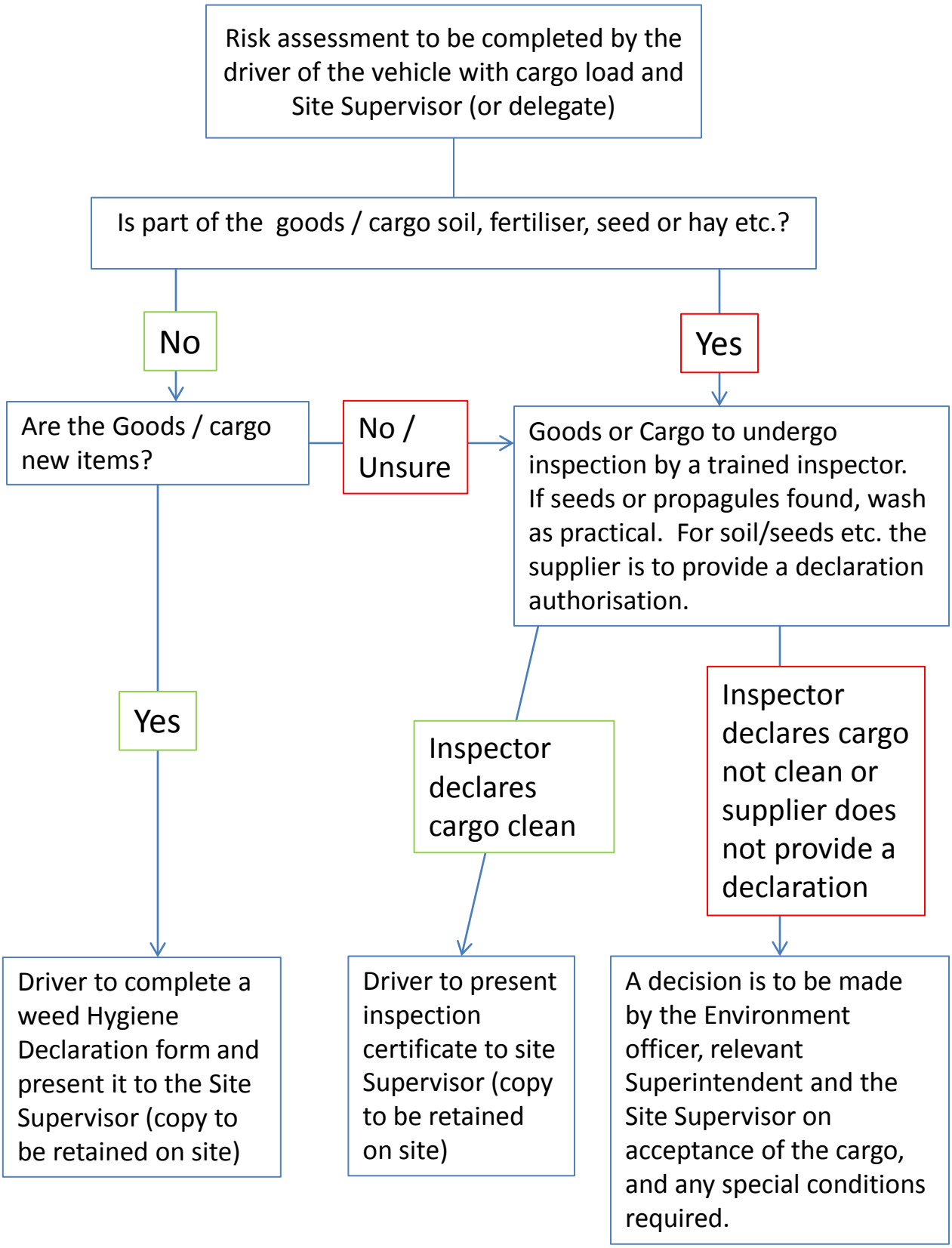
4.2.2 Cargo Risk Assessment

The cargo risk assessment procedure is provided in **Figure 4-2** and assesses the potential weed risk of cargo (materials or machinery imported onto site) based on its content and source. Organic cargo is considered to be of high risk and requires inspection in accordance with the assessment procedure. Imported material should be obtained from weed free areas. A Weed Hygiene Declaration Form (**Appendix B.2**) shall be obtained from all suppliers of gravel, sand, soil, mulch, packing material, machinery, vehicles, water and any other potentially contaminated products, to certify the product is weed/contaminant free.

Where organic material is not sourced from a certified supplier, the place of origin of the material/product shall be examined to ensure the area is free of WONS and declared weeds.

Where cargo is not of organic origin, completion of a Weed Hygiene Declaration Form (**Appendix B.2**) will not be compulsory where it can be confirmed that the cargo is from a certified supplier, and/or the cargo has not been used off hardstand tarmac road (e.g. vehicles/plant). However, where deemed appropriate, qualified site personnel (see Section 4.7) will undertake a cargo inspection. This may result in a Weed Hygiene Declaration Form being required.


Did you leave the tarmac (e.g. drive on sidings, dirt roads, or farm tracks)?
No
Yes
Was the area a known area for Declared Weeds or were Declared Weeds seen?
No
Yes
Was the dirt road or farm track muddy?
No
Yes
Did you leave the dirt road or farm track?
No
Yes
Was the area of unknown weed status or were potential weeds seen that were unidentified?
No
Yes or Unsure
No
Was the area muddy?
Yes
Did you leave the vehicle and work in a known weed infested area, in an area where weed were observed, or in a muddy or wet area?
Yes
No
Step 1 Washdown required
No Washdown required
Full washdown required


Risk assessment to be completed by the driver of the vehicle with cargo load and Site Supervisor (or delegate)
Is part of the goods / cargo soil, fertiliser, seed or hay etc.?
No
Yes
Are the Goods / cargo new items?
No / Unsure
Goods or Cargo to undergo inspection by a trained inspector. If seeds or propagules found, wash as practical. For soil/seeds etc. the supplier is to provide a declaration authorisation.
Yes
Inspector declares cargo clean
Inspector declares cargo not clean or supplier does not provide a declaration
Driver to complete a weed Hygiene Declaration form and present it to the Site Supervisor (copy to be retained on site)
Driver to present inspection certificate to site Supervisor (copy to be retained on site)
A decision is to be made by the Environment officer, relevant Superintendent and the Site Supervisor on acceptance of the cargo, and any special conditions required.

4.3 Access Procedures

Restricted Access Procedures	
Goal	To control access in infested areas in accordance with risk analysis and planning (**Section 4.2**) outcomes to control the spread of weeds.
Outcomes	• Distribute updated GIS weed maps, that have been created from site inspections and using the Queensland government website (DPI 2009)as a basis, to personnel and contractors; • Provide updated procedures to relevant employees; and • Compliance with wash-down requirements.
Actions	• Vehicles, equipment, and tools etc. are to be cleaned down in accordance with risk analysis (**Section 4.2**) and wash-down procedures before entering or leaving the Project area (including off lease infrastructure areas); • Access routes shall be clearly identified by site manager with signs in the field; • Work zones will be identified in the field and field personnel will minimise soil, seed and organic matter transfer across work zone boundaries; • All vehicles and equipment to be confined to approved roads, tracks, Right of Ways (ROWs) and work areas only, in order to minimise contact with vegetation and cross contamination; and • Vehicles travelling off approved access roads and tracks will be subject to risk analysis and wash-down procedures.
Performance Indicators	• Vehicle/Machinery Inspection (refer **DAFF, 2000a**) completed and reported; and • Weed mapping and wash-down locations up to date.
Monitoring, Reporting and Corrective Actions	In accordance with **Section 4.8** of this PWMP.
Responsible Persons	Refer to **Section 4.6**.
Associated Documentation	• Risk Analysis Process (refer **Section 4.2**); • Vehicle/Machinery Inspection (refer **DAFF, 2000a**).; and • Updated GIS weed map.

4.3.1 Access Management

Access to work areas will need to be managed to prevent the spread of weeds. Steps that will be followed to manage work areas will include;

- Determining the status of the proposed work area:
  - Verify whether the work zone is weed free. This can be done by referring to the GIS map, and making use of local knowledge (e.g. site manager, weed officers, and environmental officers/advisors).
- Review and identify any known weeds currently in the work zone. If weeds are known to be within the work area, refer to the Personnel, Vehicle and Machinery Risk Assessment (**Section 4.2.1**) to be followed. Once the work activity is accessed the degree of wash-down cleaning that will be required, prior to leaving the Project area (including off lease infrastructure areas), will be known.
  - Wash-down - Steps 1 and 2;
  - Internal clean and personnel shakedown – Step 1 only; or
  - Visual inspection and possible wash-down or internal clean if required.
- Assess the condition of materials brought on site using the cargo risk assessment procedure. Supplied materials which may include but not be limited to vehicles and machinery, soil, and water.

Note the origin and route taken to determine the potential for weed contamination. A Weed Hygiene Declaration Form (**Appendix B.2**) will be required for all organic materials brought on site. The form requires an assessment be undertaken to determine:

- Where the potential weed sources come from and by what route?
- Has the potential weed source come from an area of high infestation or known weed free area?
- Has the potential weed source been transported via sealed roads, dirt roads, uncontrolled tracks, ROWs, or fields?
- Has the potential weed source been washed, quarantined, chemically treated, or certified clean?
- Has the potential weed source been subject to the appropriate wash-down procedures?
- Where is the potential weed source's final destination?

- Once the Weed Hygiene Declaration Form has been completed, the form will assist field personnel in determining the risk of weed contact and potential for further spread. The field personnel can then make a more informed decision on which precautions need to made and acted on. The form provides the following:
  - Assurance that the source is weed free, or the source is being transported in a safe manner such that the risk of spreading weeds is minimised;
  - A record of vehicle cleanliness; and
  - Documented record that provides the person receiving the weed source with some information about the material.

4.4 Wash-down Procedures

Wash-down Procedures	
Goal	To prevent the spread of weeds.
Outcomes	Vehicles and equipment clean of plant, seed and other propagation material.
Actions	• All field personnel will be trained in the proper wash-down procedures specific to their role and know the location of the wash-down facilities. • All vehicles, equipment and tools are to be certified clean prior to entry and exit from the Project area (including off lease infrastructure areas). Approved certification includes Weed Hygiene Declaration form (**Appendix B.2**) issued by a suitably qualified weed inspector. Documentation including vehicle registration number, date of inspection, inspection location and signature of authorising person will be included; • Copy of the Weed Hygiene Declaration to remain with vehicle. All vehicles and equipment must display certification appropriate to the work area; • Only approved personnel can issue Weed Hygiene Declarations. This can include suitably qualified Hancock staff, cargo suppliers, and drivers of vehicles that only travel on the tarmac; • Vehicles and equipment failing inspection must be re-washed and re-inspected to be approved to enter or exit the Project area (including off lease infrastructure areas); • Use only Hancock approved wash-down facilities; • Keep all vehicles and equipment visually clean (as practicable) at all times; and • Ensure no plant debris adhering to clothing.
Performance Indicators	• All field personnel aware of wash down procedures and location of wash down facilities • Presence of weeds in the work area consistent or less than adjacent land

Wash-down Procedures	
	infestations; and • No new infestations of weeds reported in the Project area (including off lease infrastructure areas).
Monitoring, Reporting & Corrective Actions	In accordance with **Section 4.8** of this PWMP.
Responsible Persons	Refer to **Section 4.6**.
Associated Documentation	• Wash-down Procedure (refer DAFF**, 2000**) • Wash-down checklist (refer **Appendix B.1**); • Risk Analysis Procedure (refer **Section 4.2 Figures 4-1 and 4-2**); • Vehicle/Machinery Inspection procedure (refer **DAFF, 2000a**); and • Hygiene Declaration Form (refer **Appendix B.2)**.

4.4.1 Weed Avoidance

To avoid the spread of weed the following steps will be undertaken:

- To determine if you are likely to be traveling through a weed infested area, check with updated weed map;
- Ensure clothing is free from weed seeds or mud before entering vehicle;
- Avoid working in infested areas in wet or dewy conditions;
- When working in weedy areas, work in order of severity of infestation. Least first, through to most infested;
- Where possible, determine a route that avoids infested areas; and
- Always wash-down vehicle after leaving the Project area (including off lease infrastructure areas).

4.4.2 Wash-down Procedure

If weed infestations cannot be avoided and the risk assessment determines that a wash down is required before the vehicle / plant / cargo leaves the Project area (including off lease infrastructure areas), the following steps should be undertaken;

- Proceed to the wash-down area choosing a route that requires travel through areas of similar or greater weed infestation than the area in which the vehicle/equipment was working;
- Ensure vehicle/equipment is parked/placed in a safe manner on wash pad and free of obstructions;
- Engine off and brakes on with wheel chocks and have all attachments and accessories accessible for cleaning;
- Clean all parts with water in accordance with vehicle wash-down procedure **(DAFF, 2000);**
- Clean underneath vehicle first then wash the upper body. Ensure any tool boxes, storage containers or compartments are checked;
- Carry out final inspection and rewash if required;
- When washing completed move vehicle/equipment slowly off wash pad to avoid re-contamination;
- Hose down the wash area to avoid contaminating future vehicles; and
- Fill in and date the weed wash down checklist appropriate to the vehicle (example form in **Appendix B.1**) and the Weed Wash-down facility attendance book.

4.4.3 Inspection Procedures

Inspections to complete a Weed Hygiene Declaration Form should follow the procedures outlined in Queensland Government inspection manual (DAFF 2000a). These procedures can also be used to determine if a weed wash-down is required after working in an area with an unknown weed status or where you have not left the road or track in dry conditions. The manual provides check points on different vehicles where seeds or propagules may have deposited themselves.

4.4.4 Wash-down Facilities

Wash-down facilities can be temporary or permanent. The wash water/sludge containing weed material and seeds should be contained on site and disposed of in an appropriate manner to prevent the dislodged seeds from germinating. Regular site inspections around wash-down facilities should be made to verify that there is no new weed seed germination. Wash-down facility requirements are covered in detail in the Queensland Guidelines for the Construction of Vehicle and Machinery Wash-down Facilities (DAFF, 2000b).

4.4.4.1 Temporary Wash-down Facility

If work activities are short term or if permanent wash-down facilities are unavailable, temporary wash-down facilities may be adequate. The wash-down facility should conform to the Queensland Guideline for the construction of Vehicle and Machinery Wash-down Facilities (DAFF 2000b). When considering possible selection sites, the following options should be considered in accordance with the Queensland Checklist for Clean down Procedures (DAFF 2000b)).

Location

Ensure the site drainage does not runoff into water courses. This will prevent plants, seeds, fuels, contaminants and detergents from entering local water courses. Refer to the prevention of pollution of ground water and surface water in the *Environmental Protection (water) Policy, 2008* and the *Environmental Protection Act, 1994*. If required, bunds or other containment options may have to be implemented. The following guidelines should be implemented when considering location of a temporary wash-down facility:

- The site should be relatively flat to keep wash-down spay contained and avoid slippery surfaces for operating personnel. A slight slope can assist is preventing water ponding and erosion;
- Landholders should be consulted to determine a suitable wash-down location, and the site should be visibly marked for future wash-downs;
- The site should be well vegetated to help prevent future weed seeds from germinating;
- If possible, the wash-down site should be located near but just outside the current infestation area to control further spread; and
- Avoid crossing clean property areas before reaching wash-down site.

Site Criteria

The availability of hardstand areas may be one of the limiting factors in determining the duration over which the wash-down location may be used. A hardstand area is defined as a hard surface which will not allow soil transfer to the tyres of a clean vehicle, even when wet. Areas where hardstand criteria are required are described in the Queensland Guidelines for the Construction of Vehicle and Machinery Wash-down Facilities (DAFF, 2000b).

- Areas used for off-loading and the actual wash-down area itself for the vehicles and associated items;
- Staging areas used for reloading of clean equipment; and
- All roads between the wash-down area and the reloading staging area.

The size of the hardstand area required will vary depending on the number of vehicles and the amount of time available. The minimum size required in order to minimise wash-down congestion includes:

- At least 40 m on the ends of the wash-down area and at least 15 m on each side; and
- Staging areas to be at least 50 m long and 15 m wide.

Each wash-down location should be individually evaluated for size and usage time-frame when the final location has been determined.

Equipment

Typical equipment required at wash-down facilities includes:

- Wash tracks – the number of wash-down tracks will vary depending on the individual wash-down area. It is estimated that an average wash-down will take approximately half hour per vehicle. The wash tracks should be designed to consider safety, vehicle movements on and off the tracks, and ease of work. Vehicles and equipment should be inspected before they are removed from the wash track and re-washed if required;
- A mobile water tank or truck with low pressure, high volume hoses (these are considered the most effective for seed removal). Large quantities of water may be used in short time periods, so the quantity of water supply available will have to be evaluated. If water availability is an issue or where the water cannot be reclaimed and recycled, high pressure low volume can be used;
- Depending on site location, fresh water may be pumped directly from a dam or cattle trough. Saline water should not be used as this will corrode equipment. If grey water is used it must comply with all current legislative and health requirements for industrial use;
- Air compressor for cleaning dry materials;
- Broom/dustpan for collecting seeds inside cabins, truck trays, and toolboxes; and
- Attendance book for users to sign and leave details of the vehicle washed.

4.4.4.2 Permanent Wash-down Facility

For long term work assignments permanent wash-down facilities may be constructed. For a list of current wash-down facilities contact the local council. The following options should be considered in accordance with the Queensland checklist for wash-down procedures (DNR 2000b) (refer DAFF, 2000).

The location and site criteria will be the same as for the temporary wash-down facility.

Equipment

Typical equipment required at permanent wash-down facilities includes:

- Wash tracks or concrete pad – the number of wash-down tracks will vary depending on the individual wash-down area. It is estimated that an average wash-down will take approximately half hour per vehicle. The wash area should be designed to consider safety, vehicle movements on and

off the tracks or pad, and ease of work. Vehicles and equipment should be inspected before they are removed from the wash-down area and re washed if required;
- Large quantities of water may be used in short time periods, so the quantity of water supply available will have to be evaluated. A minimum of two low pressure high volume hose lines for each wash track should be provided;
- Water capture, filtering and recycling devices should be used to ensure no contaminated material is lost from site. It will also decrease the quantity of water required if it can be recycled;
- Depending on site location, fresh water may be pumped directly from a storage container. Saline water should not be used as this will corrode equipment. If grey water is used it must comply with all current legislative and health requirements for industrial use;
- Air compressor for cleaning dry materials;
- Broom / dustpan for collecting seeds inside cabins, truck trays, and toolboxes; and
- Attendance book for users to sign and leave details of the vehicle washed.

4.5 Compliance Checks

Compliance Checks	
Goal	To ensure the system is being applied efficiently and effectively, and is managing the objective of controlling weed spread.
Outcomes	• No spread of weeds external to the Project area and no new weed infestation within the Project area (including off lease infrastructure areas); • Personnel and contractors adhering to wash-down and access requirements; and • Vehicles and equipment being maintained in weed material, organic matter and seed free condition.
Actions	• Spot checks of vehicles and equipment will be randomly carried out by Hancock environment officers in accordance with Vehicle/Machinery Inspection procedure (refer **DAFF, 2000a**); • Vehicles and equipment will be checked pre and post work activities; • All completed checklists shall be filed on site in accordance with the document control system; and • Vehicles and equipment failing spot checks shall be sent for wash-down at the nearest facility.
Performance Indicators	• Wash-down logs correspond with daily reports; • Spot checks completed and vehicles found to be in appropriate state of cleanliness; and • GIS weed mapping and wash-down locations up to date.
Monitoring, Reporting and Corrective Actions	In accordance with **Section 4.8** of this PWMP.
Responsible Persons	Refer **Section 4.6**.
Associated Documentation	• Vehicle wash-down procedure (refer DAFF, 2000); and • Vehicle/Machinery Inspection procedure (refer DAFF, 2000a).

4.5.1 Timing

Compliance checks will be carried out by both appropriate on site personnel and an independent contractor. Independent compliance checks should be carried out annually with spot checks on vehicle logbooks ongoing throughout the year. Inspection procedures will follow the Queensland Government Inspection Procedures Manual (DAFF, 2000) and also include an audit of wash-down logs and Weed Hygiene Declaration Forms to ensure an appropriate level of reporting.

4.6 Responsibilities

Position	Responsibility
Environment officers	• Assessing the requirement of the PWMP in consultation with Operations management; • Consulting with relevant authorities on behalf of Operations; • Providing advice regarding the presence of weeds and pest animals and legislative requirements; • Contributing to the development of Pest and Weed Management Plans for existing and new operational areas; • Organising compliance checks and external audits; • Completing Weed Hygiene Declaration forms on vehicles and cargo entering the site especially cargo carrying organic material; and • Undertaking weed control activities or organising external weed control contractors.
Operations Managers	• Initiating the weed/pest animal identification process; • Assessing the requirement of the PWMP • Contributing to the ongoing development of PWMP for existing and new operational areas; • Implementing applicable PWMP; • Ensuring vehicle wash-down procedures are implemented; • Ensuring appropriate staff undergo training to be able to issue Weed Hygiene Declaration forms on vehicles and cargo entering the site; and • Ensuring documentation and records relating to weed and pest animal management are recorded and maintained.
Team Leader Transport and Distribution	• Ensuring procedures to check and clean machinery and equipment that may be moving from infested to clean areas are implemented; and • Completing Weed Hygiene Declaration forms on vehicles and cargo entering and leaving the site (when appropriately trained).
Field Services / Maintenance Superintendent(s)	• Implementing processes / procedures to prevent transfer of weeds or animal pests from infested to clean areas; • Implementing PWMP; and • Completing Weed Hygiene Declaration forms on vehicles and cargo entering and leaving the site (if appropriately trained).
Team Leader Project Execution	• Ensuring procedures to check and clean machinery associated with projects that may be moving from infested to clean areas are implemented.
All personnel	• Follow requirements of PWMP including assessing vehicles and cargo in accordance with the requirements of weed identification, weed wash-down procedure, and weed inspection procedures (refer Appendix B and DAFF 2000a.)

4.7 Training

Training in basic weed identification and risk analysis and planning will be required for all personnel. This will include:

- A weed identification session as part of the induction procedures;
- Weed picture books will be produced and displayed at convenient locations to assist in identification;

- Training session on how to evaluate the risk using the flow chart in **Figure 4-1** and how to decide on a wash-down or inspection procedure; and
- How to correctly wash down and inspect a vehicle.

Training for personnel required to issue Weed Hygiene Declarations or undertake compliance checks will require attending an accredited course such as that provided by Greening Australia – Contaminated Machinery Certificate. These individuals will then be able to provide Weed Hygiene Declarations to certify clean vehicles and machinery leaving or entering site.

4.8 Monitoring and Reporting

4.8.1 Monitoring

Ongoing monitoring of the following shall ensure effectiveness of the PWMP:

- Training (including weed identification, PWMP procedures, record keeping and document filing);
- Compliance of personnel;
  - Compliance can be verified using on-the-spot checks to compliance with wash-down and inspection protocols by auditing wash-down facilities, and entrances and exits to the Project areas including off lease infrastructure areas.
  - Compliance can also be checked by auditing logbooks of vehicles and wash-down facilities attendance books as well as the site's records for Weed Hygiene Declaration forms. Ensuring copies of all documents are filed on site in accordance with the document control system; and
- Current weed distribution information to identify data gaps and need for further mapping data for incorporation into the PWMP;
  - The map should be updated by Hancock after any extreme periods of rainfall or droughts, as weed growth will vary widely due to the germination characteristics of weed seeds, which vary in response to changing soil moisture content.
  - Site personnel should alert the environment officer of any new weed or pest sightings. The environment officer should investigate and add the findings to the weed mapping.

4.8.2 Reporting

Reports	Responsibility	Location
Wash-down log books	• All personnel	• Every vehicle will have its own wash-down log book • Wash-down facilities will have an attendance book
Weed hygiene declarations	• Vehicle driver if vehicle has not travelled off tarmac. • Qualified site personnel if vehicle or cargo has been used off road or produced off site.	• Declarations should be filled in after inspection of vehicles or machinery when entering or leaving site. • Documents to be kept on site and filed on site in accordance with the document control system.
Compliance checks	• Environmental officer	• Compliance check results to be circulated to staff (without naming names). • Compliance reports to be filed on site

Reports	Responsibility	Location
		in accordance with the document control system.
Independent audits	• External contractor	• Independent audit results should be reported to senior management and filed with the environment officer on site in accordance with the document control system.
Weed control activities	• Suitably qualified external contract or internal environmental officer	• Reports to say when, where and how weeds and pests are treated to be kept by the environment officer and filed on site in accordance with the document control system.

4.8.2.1 Wash-down Log Books

Every vehicle will have its own wash-down logbook. It will be the responsibility of the operator to fill in the checklist and sign it after each wash-down and inspection. An example of a wash-down checklist and report page are presented in **Appendix B.1**

Wash-down facilities will have an attendance book to be signed, dated and the registration noted for each vehicle using the facilities.

4.8.2.2 Weed Hygiene Declarations

Any Hancock personnel operating a vehicle are able to make a Weed Hygiene Declaration for their vehicle if the vehicle has not travelled off tarmac. If the vehicle, machinery or cargo has come from an external source or has been used off road a suitably qualified site personnel (having undertaken Contaminated Machinery Certificate or equivalent) is needed to declare it weed free.

Declarations should be filled in after inspection of vehicles or machinery when entering or leaving site. These declarations will be kept on the vehicle.

4.8.2.3 Compliance Checks

Compliance checks will be carried out by the environmental officer monthly. The results of the spot checks conducted during the quarter shall be circulated to staff in a way that helps staff learn and promotes better compliance (without naming names).

Compliance reports will be filed on site in accordance with the document control system.

4.8.2.4 Independent Audits

Independent audits will be conducted yearly to assess compliance with legislative and local government requirements and compliance with the PWMP. Independent audits should be conducted by an independent consultant or the local government environment officer. Independent audit results should be reported to senior management and the environmental officer and filed on site in accordance with the document control system.

Any breaches in compliance should be outlined and actions to remedy recommended. The environment officer will undertake these recommendations or organise external contractors.

4.8.2.5 Weed Control Activities

Weed control activities will be undertaken by a suitably qualified external contract or internal environmental officer (Chemical handling licence). Reports will cover when, where and how weeds and pests are treated. Information will also be provided as to when follow up activities will be required. Weed control activity reports will be kept by the environment officer and filed on site in accordance with the document control system.

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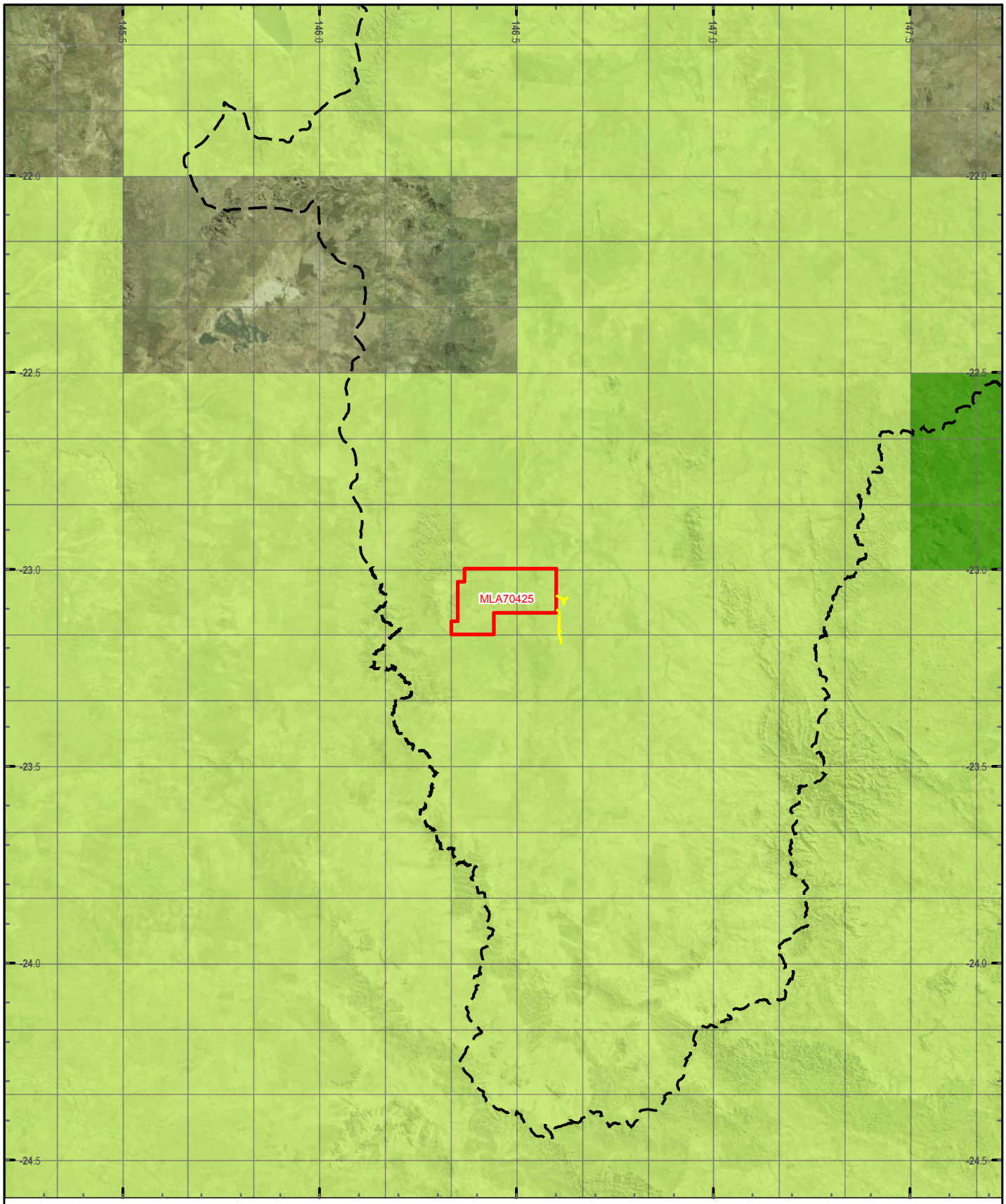
Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

A

Appendix A Weed and Pest Distribution and Control

A.1 Prickly Pear

Including common pest pear, velvety tree pear and westwood pear



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Kevin's Corner Project
Supplementary Environmental Impact Statement

PEST DISTRIBUTION SURVEY 2005: COMMON PRICKLY PEAR *(Opuntia stricta)*

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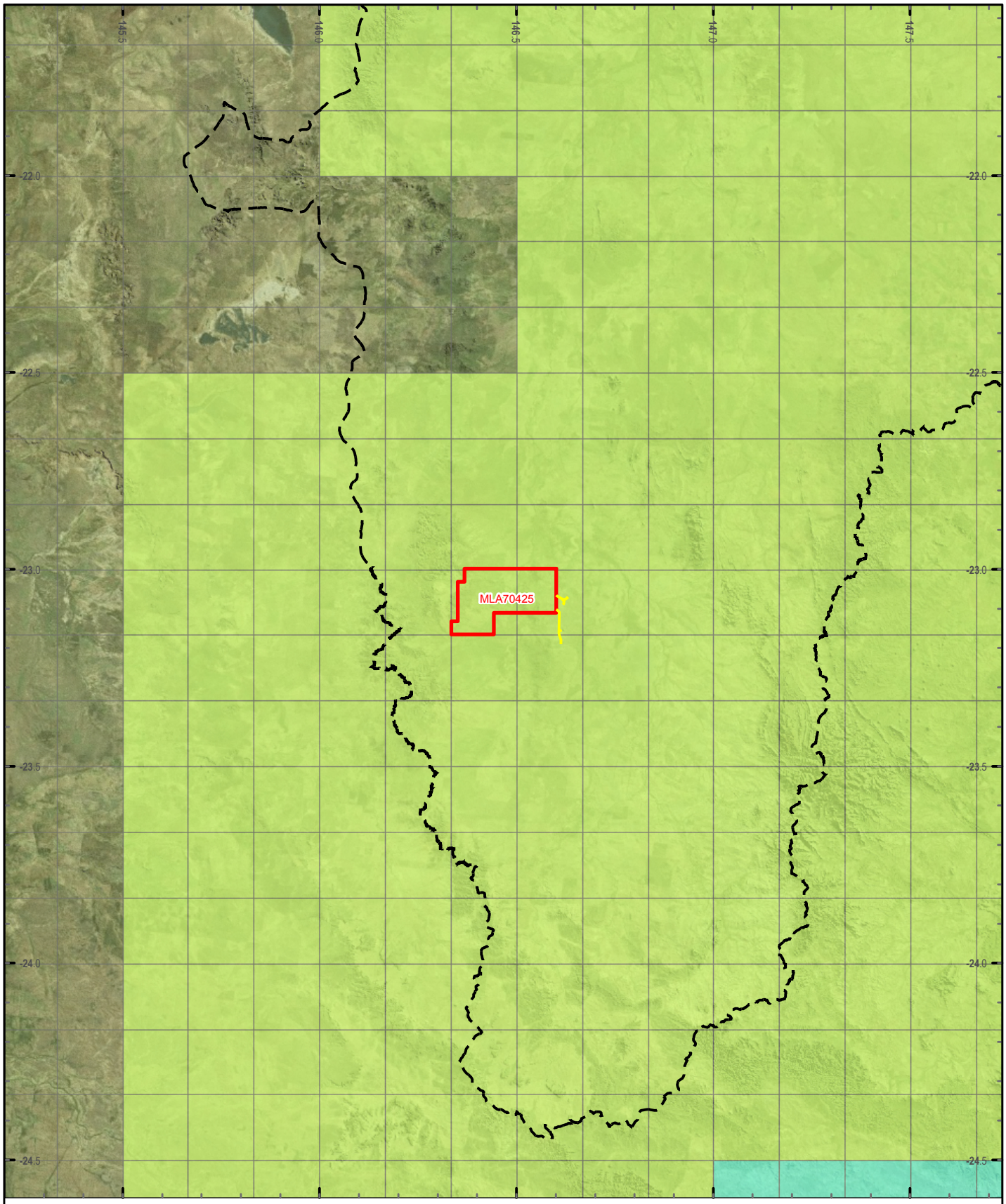
PEST AND WEED MANAGEMENT PLAN

Figure: **A.1a**

File No: **42626920-g-2056.mxd** Drawn: **XL** Approved: **KM** Date: **30-08-2012** Rev. **B** A4



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PEST DISTRIBUTION SURVEY 2005: VELVETY TREE PEAR *(Opuntia tomentosa)*

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PEST AND WEED MANAGEMENT PLAN

Figure: **A.1b**

File No: **42626920-g-2057.mxd** Drawn: **XL** Approved: **KM** Date: **30-08-2012** Rev. **B** A4

Prickly pear

Opuntia, *Nopalea* and *Acanthocereus* spp.

The introduction and spread of prickly pears into Queensland and New South Wales is one of the greatest environmental invasions of modern times.

Prickly pears were introduced into pastoral districts in the 1840s. By 1900, over 4 million hectares in Queensland and New South Wales was infested by prickly pear. By 1925, the pest had invaded over 24 million hectares. Control costs were prohibitive and the only effective herbicide at the time was hazardous. This resulted in landholders abandoning large tracts of land.

Research for biological control agents commenced in 1912, and in 1914 cochineal insects were released to control one of the minor prickly pear species. Control of this minor prickly pear species by these introduced insects occurred within a few years.

The success of the cochineal insects led to renewed efforts against other types of prickly pear in the 1920s. These efforts resulted in the control of the major pest prickly pear by the moth *Cactoblastis cactorum*; by the mid-1930s, prickly pear was no longer a major problem.

Several prickly pear species have since remained as minor weeds.

PP29 February 2012

Declaration details

Prickly pear (*Opuntia* spp.) is a declared Class 1 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. *O. ficus-indica* is not declared. *O. Stricta, O. aurantiaca, O. monacantha, O. tomentosa* and *O. streptacantha* species are Class 2 declared pest plants and all other species are declared Class 1.

Description and general information

'Prickly pear' is a general term used to describe some plants of the Cactaceae family. The term includes species of *Opuntia, Nopalea* and *Acanthocereus*. All of these plants originate in the Americas. The term 'prickly pear' relates to the fruit that is often spiny and pear-shaped. Plants are normally leafless succulent shrubs. Stems are divided into segments (pads or joints) that are flat and often incorrectly called leaves.

Young shoots have true leaves resembling small fleshy scales that fall off as the shoot matures.

Flowers are large, normally seen during spring and can be yellow, orange, red, pink, purple or white depending on the species. Prickly pear fruits vary between species and can be red, purple, orange, yellow or green.

Areoles (spots with clusters of spines) are found on both the pads (joints, segments) and fruit. In addition to spines, areoles often have clusters of sharp bristles (glochids) and tufts of fibre ('wool'). Each areole contains a growing point that can produce roots or shoots.

Life cycle

Prickly pears have several features that enable them to compete and become pests.

Prickly pears are drought resistant because of their succulent nature, their lack of leaves and their thick, tough skins. These features result in plants that use the majority of their internal tissues for water storage and their outer parts to reduce water loss and damage by grazing and browsing animals. They can remain vigorous in hot, dry conditions that cause most other plants to lose vigour or even die. Some species develop underground bulbs that enable the plant to resist fire and mechanical damage.

Prickly pears reproduce both sexually and asexually. Birds and other animals readily eat the many seeded fruits and deposit seeds in their droppings. Seeds have hard seed coats that allow them to survive heat and lack of water. Asexual reproduction (cloning) of prickly pears occurs when pads (joints, segments) or fruits located on the ground take root and produce shoots. Animals and floods move broken pads long distances. These pads can survive long periods of drought before weather conditions allow them to set roots.

Habitat and distribution

Prickly pears considered pests in Queensland are:

- Common pest pear (= *O. inermis*) — *Opuntia stricta* var. *stricta*
- Spiny pest pear (= *O. stricta*) — *Opuntia stricta* var. *dillenii*
- Tiger pear — *Opuntia aurantiaca*
- Drooping tree pear (= *O. monacantha*) — *Opuntia vulgaris*
- Velvety tree pear — *Opuntia tomentosa*
- Westwood pear — *Opuntia streptacantha*
- Devil's rope pear — *Opuntia imbricata*
- Coral cactus — *Opuntia cylindrica*
- Snake cactus X *O. imbricate* — *Opuntia fulgida*
- Sword pear — *Acanthocereus pentagonus*

Common pest pear (*Opuntia stricta* var. *stricta*)

This bushy, spreading plant grows up to 1.5 m high and forms large clumps. The stems are divided into oval, blue-green spineless pads 20 cm long and 10 cm wide. Areoles are in diagonal lines along the pads 2.5 cm to 5 cm apart and have a cushion of brown wool containing bristles but usually no spines. When spines occur they are stout, yellow and up to 4 cm long.

Common pest pear produces flowers that are 7.5 cm wide, bright lemon yellow and green at the base. The fruit is oval-shaped, has a deep cavity on one end and tapers at the other. Fruit is purple, 6 cm long and 3 cm wide, with carmine-coloured (dark red) seeds and a fleshy pulp.

Common pest pear is found as small to large clumps of varying density. The clumps are usually broken up by the action of *Cactoblastis cactorum*. Common pest pear occurs throughout most of central and southern Queensland and is still spreading westwards. It is often found along beaches and on offshore islands.

Spiny pest pear (*Opuntia stricta* var. *dillenii*)

This succulent shrub grows 1–2 m high. The stems are hairless and bluish-green or dull green. The stems are divided into pads up to 30 cm long, 15 cm wide and 1–2 cm thick. The areoles have tufts of short and finely barbed bristles accompanied by one or two yellow spines between 2 cm and 4 cm long. Small scale-like leaves are found on areoles of immature pads.

Spiny pest pear produces 6–8 cm wide flowers that are lemon yellow with green or pink markings on the back. The fruit is pear-shaped and about 4–6 cm long with a red-purple skin. The areoles located on fruits have fine, barbed bristles. The red flesh of fruits contains rounded seeds that are yellow or pale brown.

While this prickly pear once formed large-scale dense infestations, it is now found as small clumps or as scattered plants. These clumps are usually broken by the action of *Cactoblastis cactorum*. It is found in eastern central Queensland, the Burnett district, the Darling Downs and south-eastern Queensland.

Tiger pear (*Opuntia aurantiaca*)

This succulent low shrub with underground tubers usually grows 30–60 cm high. The stems are divided into very spiny, slightly flattened pads that are 1–30 cm long and 1–5 cm wide. The stems are dark green to purple and red in colour. The areoles have 3–7 brown barbed spines up to 4 cm long surrounded by tufts of short, fine bristles. The pads detach easily and are transported on the skins of animals. Small and scale-like leaves are found on areoles of immature pads.

Tiger pear produces 6 cm wide yellow flowers. The rarely formed fruits are pear-shaped and about 2.5 cm long. When ripe, they are red with purple markings.

Dense tiger pear forms an impenetrable spiny groundcover and is prevalent in southern Queensland but extends into central Queensland.

Drooping tree pear (*Opuntia vulgaris*)

This erect succulent shrub with fibrous roots grows up to 5 m high but is usually 2–3 m high. The branches are divided into glossy light green pads up to 45 cm long, 15 cm wide and 1.5 cm thick. The dark grey trunk grows up to 25 cm in diameter. Drooping tree pear gets its name because the upper segments tend to droop. The areoles on the older pads have 1–5 sharp spines about 5 cm long.

Small, scale-like leaves are found on areoles of very young pads that are quickly shed as the pad grows. Drooping tree pear produces yellow flowers that are 6 cm wide and have red markings on the back. The fruit is pear-shaped and 4–7 cm long with a green skin. The flesh of the fruit is red, pulpy and contains round seeds that are yellow or pale brown. The fruits have areoles with tufts of fine, barbed bristles.

Dense thickets result when drooping tree pear is allowed to grow freely. Small scattered infestations occur in the south-east corner of Queensland and in coastal northern Queensland.

Velvety tree pear (*Opuntia tomentosa*)

This tree-like plant forms a central woody trunk over 40 cm wide and grows up to 5 m high. The stems are divided into oblong pads that are dull green and velvety to touch due to the dense covering of short fine hairs. The pads are 15–35 cm long, 8–12 cm wide and 1.5–2 cm thick.

Young plants have 2–4 white or pale yellow spines located in the areoles with one spine reaching a length of 2.5 cm. The areoles usually become spineless as the plant matures. A more spiny variety does exist and has more than 50 spines in each areole on the trunk.

The flowers are a deep orange. The fruit is egg-shaped, about 5 cm long and 3 cm wide, and dull red. The top of the fruit is saucer-shaped with circular lines that meet in the centre and give the fruit a shrivelled appearance. The fruit produces many seeds within a reddish pulp.

Velvety tree pear is found predominantly throughout the brigalow belt of Queensland and is still extending its range. It is occasionally found as dense shrubs, but more usually as small clumps of trees or as trees scattered over the landscape.

Westwood pear, Cardona (*Opuntia streptacantha*)

Westwood pears are shrub-like or tree-like plants that form clumps by branching from the base. They are usually 2–4 m high. The stems are divided into almost circular dull green pads, 25–30 cm long and 15–20 cm wide. The areoles have white spines that vary in number and size when the plant matures.

Young pads have 2–5 white spines 1–2 cm long, accompanied by two hair-like spines 0.5 cm long in the lower part of the areole. Spines increase in number (up to 20) and size (5 cm long) in areoles along the trunk of the plant.

The flowers are yellow and fruits are barrel-shaped, 6 cm long and 5 cm wide with a flat top. The fruit has a purple skin and a rind that is 1 cm thick. Fruits contain red seeds buried in a dark red (carmine) pulp.

Westwood pear is found in eastern central Queensland as small clumps or as plants scattered over the landscape.

Devil's rope pear (*Opuntia imbricata*)

This open branching shrub grows 1.5–3 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 37 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined, rope-like appearance. The areoles are found on these ridges and produce 3–11 pale yellow or white spines, with the longest being 2.5 cm long. Papery sheaths cover these spines.

The flowers are a dull, red-purple colour and found at the ends of pads. The yellow fruit resembles a small, 5 cm wide custard apple and has a spineless areole at the top.

Devil's rope pear occurs in Queensland as a small infestation at Gladfield.

Coral cactus (*Opuntia cylindrica*)

Coral cactus grows as a branching shrub 1–1.5 m in high. The stems of coral cactus are divided into green cylinder-like pads that are fist-like and obtuse at their apex. Mature coral cactus pads widen, become distorted and wavy, and resemble a piece of coral. Areoles along the pads have a number of short white spines.

Coral cactus produces small (1–2 mm wide) scarlet flowers. The fruit is yellow-green and 2–5 cm wide.

Coral cactus has been located near Mount Isa, Longreach, Wyandra, Eulo and Hungerford but its potential spread includes all of far western Queensland.

Snake cactus (*Opuntia fulgida* X *O. imbricata*)

This open branching shrub grows 1–2 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 20 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined rope-like appearance. The areoles are found on the bottom of these ridges and produce 5–10 pale yellow to brown spines, with the longest being 3 cm long.

The flowers are light red to dark rose and commonly 5–7 cm wide. Snake cactus produces fruit that is yellow and 2–5 cm wide.

Snake cactus has been located near Longreach but its potential spread includes all of north-western Queensland.

Sword pear (*Acanthocereus pentagonus*)

This elongated branching shrub grows in clumps up to 4 m high. The stems are erect, up to 1.5 m long, 3–8 cm wide and divided into many joints. Sword pear stems are three-, four- or five-angled and resemble star-picket posts. The areoles are found on the edges of the joints and produce many white spines 1–4 cm long.

The flowers are white, funnel-shaped and 14–20 cm long. The flowers open at night between spring and summer. Sword pear produces bright red sphere-shaped fruits that are 5 cm in diameter. The fruit has a red pulp and black seeds.

Sword pear occurs in the Gogango area west of Rockhampton.

Control

Biological control

Investigations into biological control agents against prickly pears began in 1912. Over 150 insect species were studied throughout the world, with 52 species selected for transport to Queensland. Following intensive host specificity testing, 18 insects and one mite were released in Queensland. Nine insects and the mite remain established in Queensland. These species are:

- *Cactoblastis cactorum*, a stem-boring moth
- *Dactylopius ceylonicus*, a cochineal mealybug
- *Dactylopius opuntiae*, a cochineal mealybug
- *Dactylopius confusus*, a cochineal mealybug
- *Dactylopius tomentosus*, a cochineal mealybug
- *Dactylopius austrinus*, a cochineal mealybug
- *Chelinidea tabulata*, a cell-sucking bug
- *Tucumania tapiacola*, a stem-boring moth
- *Archlagocheirus funestus*, a stem-boring beetle
- *Tetranychus opuntiae*, prickly pear red spider mite.

These biological control agents continue to keep several prickly pears under control. It is important to remember not all the agents attack all prickly pears.

The most successful of these species were the moth *Cactoblastis cactorum* and five cochineal mealybugs—*Dactylopius ceylonicus, D. opuntiae, D. confusus, D. tomentosus* and *D. austrinus*. The other agents are still around but not in sufficient numbers to provide control.

Cactoblastis cactorum (cactoblastis moth)

Larvae of this moth were introduced from Argentina in 1925. Cactoblastis proved to be the most effective agent against the common and spiny pest pears, destroying massive infestations in Australia. Larvae keeps these two pest pears controlled to an acceptable level most of the time, although it is less effective in some coastal and far western areas.

The larvae collectively eat out the contents of the pads leaving empty pad skins and piles of mushy droppings. The orange and black larvae are occasionally observed on the outsides of pads. Cactoblastis also attacks most types of prickly pear but is not effective against them.

Dactylopius spp. (cochineal insects)

All female cochineal insects are small, sessile mealy bugs that spend their adult lives permanently attached to their host plants sucking plant juices. They are covered by a fine, white, waxy secretion and when crushed yield a carmine colouring. The adult males are small, free-flying insects that do not feed.

Dactylopius ceylonicus (monacantha cochineal, Argentine cochineal)

This South American mealy bug was released in 1914 and 1915 to control drooping tree pear. It destroyed the dense infestations existing at that time. It is specific to drooping tree pear and today remains the only effective biological control agent for drooping tree pear. This insect needs to be distributed manually.

Dactylopius opuntiae (prickly pear cochineal)

This mealy bug was introduced from Mexico and southern United States between 1920 and 1922. It is effective against common pest pear, spiny pest pear, velvety tree pear and Westwood pear and remains the main biological control agent against velvety tree pear and Westwood pear. This insect spreads slowly in nature and can be assisted manually.

Dactylopius confusus (prickly pear cochineal)

This mealy bug was introduced from Florida and released in 1933 against spiny pest pear. It remains effective against spiny pest pear in central Queensland but spreads slowly. This insect can be spread manually.

Dactylopius tomentosus (devil's rope pear cochineal)

This mealy bug was introduced from southern United States in 1925 and 1926. It is effective against devil's rope pear but works slowly.

Dactylopius austrinus (tiger pear cochineal)

This mealy bug was introduced from Argentina in 1932. It is specific to and effective against tiger pear. It rapidly reduces tiger pear populations but dies out in a paddock after the destruction of tiger pear. It needs to be reintroduced after tiger pear regrows.

Chelinidea tabulata (prickly pear bug)

This plant-sucking bug was introduced from Texas in 1921. It was effective against dense common pest pear before *Cactoblastis cactorum* was but is now relatively ineffective. This insect also attacks most other prickly pears. The adult is a pale brown bug up to 20 mm long that leaves characteristic round bleached spots on the surface of the cactus.

Tucumania tapiacola (prickly pear moth-borer)

This moth was introduced from Argentina in 1934 against tiger pear. Its solitary larvae feed internally and eat out tiger pear pads with limited effect. It has been observed attacking common pest pear and harrisia cactus.

Archlagocheirus funestus (tree pear beetle)

This stem-boring beetle was introduced from Mexico in 1935. It was effective against velvety tree pear and Westwood pear but has become rare since the dense stands of these prickly pears have gone.

Tetranychus opuntiae (prickly pear spider mite)

This mite was introduced from southern United States and Mexico in 1922. It was effective against common pest pear but is now rare and difficult to find. It causes distinctive scar tissue formation around areoles.

Distributing biological control agents

Cactoblastis

Cactoblastis can be spread manually by distributing eggs or larvae. Cactoblastis moths lay chains of eggs (eggsticks) on prickly pear pads from January–February and September–November. The eggsticks are distinguished from spines by their curved appearance.

1. Collect the fragile eggsticks carefully.
2. Glue single eggsticks to small pieces of paper using a starch-based adhesive.
3. Pin the egg papers to prickly pear pads. (Eggs take up to one month to hatch.)
4. Collect pads or plants in which larvae are obviously still active.
5. At a release site place all the collected plant material in a small part of the infestation.
6. Subsequent generations of moths will disperse through the infestation.
7. Follow up the biological control with either herbicide or mechanical treatment.

Cochineals

Because several cochineal insects affect some prickly pears and not others, it is essential to know what prickly pear you wish to control.

1. Identify your prickly pear type.
2. Find the same prickly pear type which is being attacked by a cochineal.
3. Collect pads of the prickly pear with the insects.
4. Place affected pads against unaffected prickly pears at the release site.
5. Follow up the biological control with either herbicide or mechanical treatment.

Tiger pear cochineal

Tiger pear cochineal is easy to multiply quickly after collection.

1. Carefully collect a reasonable quantity of unaffected tiger pear in a container (box or bucket).
2. Place a few pieces of cochineal-affected tiger pear into the same container.
3. Cover the container with a cloth and store under cover for a few weeks.
4. Check the cactus occasionally.
5. When most of the tiger pear in the container has cochineal, it is ready to distribute.
6. At the release site place affected pads against unaffected prickly pears.
7. Follow up the biological control with either herbicide or mechanical treatment.

Note: It is best to multiply tiger pear cochineal before release.

Mechanical control

Mechanical control using machinery is difficult because prickly pear pads can easily re-establish. A hot fire is an effective control method for dense prickly pear infestations. Before burning, consult Biosecurity Queensland to see if this practice is suitable for your pasture and land management practices.

Herbicide control

Herbicide options available for the control of prickly pears in Queensland are shown in Table 1.

Landholders and contractors should check if the property is in a hazardous area as defined in the *Agricultural Chemicals Distribution Control Act 1966* prior to spraying.

Further information

Further information is available from your local government office or from your local biosecurity officer. Contact details are available through 13 25 23.

Table 1 Herbicides registered for the control of prickly pears

Pest name	Situation	Herbicide	Rate	Method
Common prickly pear	Agricultural land—non-crop	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	
	Forests—timber production	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
	Land—commercial/industrial/public	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
	Land—non-agricultural	Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
	Land—rights of way	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
	Pastures	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
Coral cactus	Agricultural land—non-crop	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
	Land—commercial/industrial	Triclopyr (240 g/L) + picloram (120 g/L)	See permit PER10550 (expires 30 June 2013)	
		Triclopyr (300 g/L) + picloram (100 g/L)		
		Triclopyr (300 g/L) + picloram (100 g/L) + aminopyralid (8 g/L)	See permit PER0532 (expires 30 June 2013)	
	Forests—timber production	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump

Continued

Pest name	Situation	Herbicide	Rate	Method
Coral cactus	Land—commercial/ industrial/public	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
	Land—rights of way	Triclopyr (300 g/L) + picloram (100 g/L)	See permit PER10550 (expires 30 June 2013)	
		Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L) + aminopyralid (8 g/L)	See permit PER0532 (expires 30 June 2013)	
	Pastures	Triclopyr (300 g/L) + picloram (100 g/L)	See permit PER10550 (expires 30 June 2013)	
		Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L) + aminopyralid (8 g/L)	See permit PER10532 (expires 30 June 2013)	
Tiger pear	Agricultural land—non-crop	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	
	Forests—timber production	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
	Land—commercial/ industrial/public	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
	Land—non-agricultural	Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
	Land—rights of way	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
	Pastures	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (600 g/L)	3 L/100 L or 0.8 L/60 L diesel	Basal bark/cut stump
			3 L/100 L or 1 L/75 L diesel	Foliar
Drooping tree pear	Agricultural land—non-crop	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (600 g/L)	0.8 L/60 L diesel	
	Forests—timber production	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	0.8 L/60 L diesel	Basal bark/cut stump
			1 L/75 L diesel	Foliar
	Land—around buildings	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
	Land—commercial/ industrial/public	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
		Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	0.8 L/60 L diesel	Basal bark/cut stump
			1 L/75 L diesel	Foliar

Continued

Pest name	Situation	Herbicide	Rate	Method
Drooping tree pear	Land—non-agricultural	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	0.8 L/60 L diesel	Basal bark/cut stump
	Land—rights of way	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
		Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	0.8 L/60 L diesel	Basal bark/cut stump
			1 L/75 L diesel	Foliar
	Pastures	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
		Triclopyr (300 g/L) + picloram (100 g/L)	0.5 L/100 L	
		Triclopyr (600 g/L)	0.8 L/60 L diesel	Basal bark/cut stump
			1 L/75 L diesel	Foliar
Velvety tree pear	Agricultural land—non-crop	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
	Forests—timber production	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
	Land—around buildings	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
Velvety tree pear	Land—commercial/ industrial/public	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
		Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
	Land—non-agricultural	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
	Land—rights of way	Amitrole (250 g/L) + ammonium thiocyanate (220 g/L)	1 mL/3 cm (inject) or 1 L/25 L (small plants/regrowth)	
		Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
	Pastures	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump
Spiny pest pear Westwood pear Devil's rope pear Snake cactus	Agricultural land—non-crop Forests—timber production Land—commercial/ industrial/public Land—rights of way Pastures	Triclopyr (240 g/L) + picloram (120 g/L)	1 L/60 L diesel	Basal bark/cut stump

Fact sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DEEDI does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

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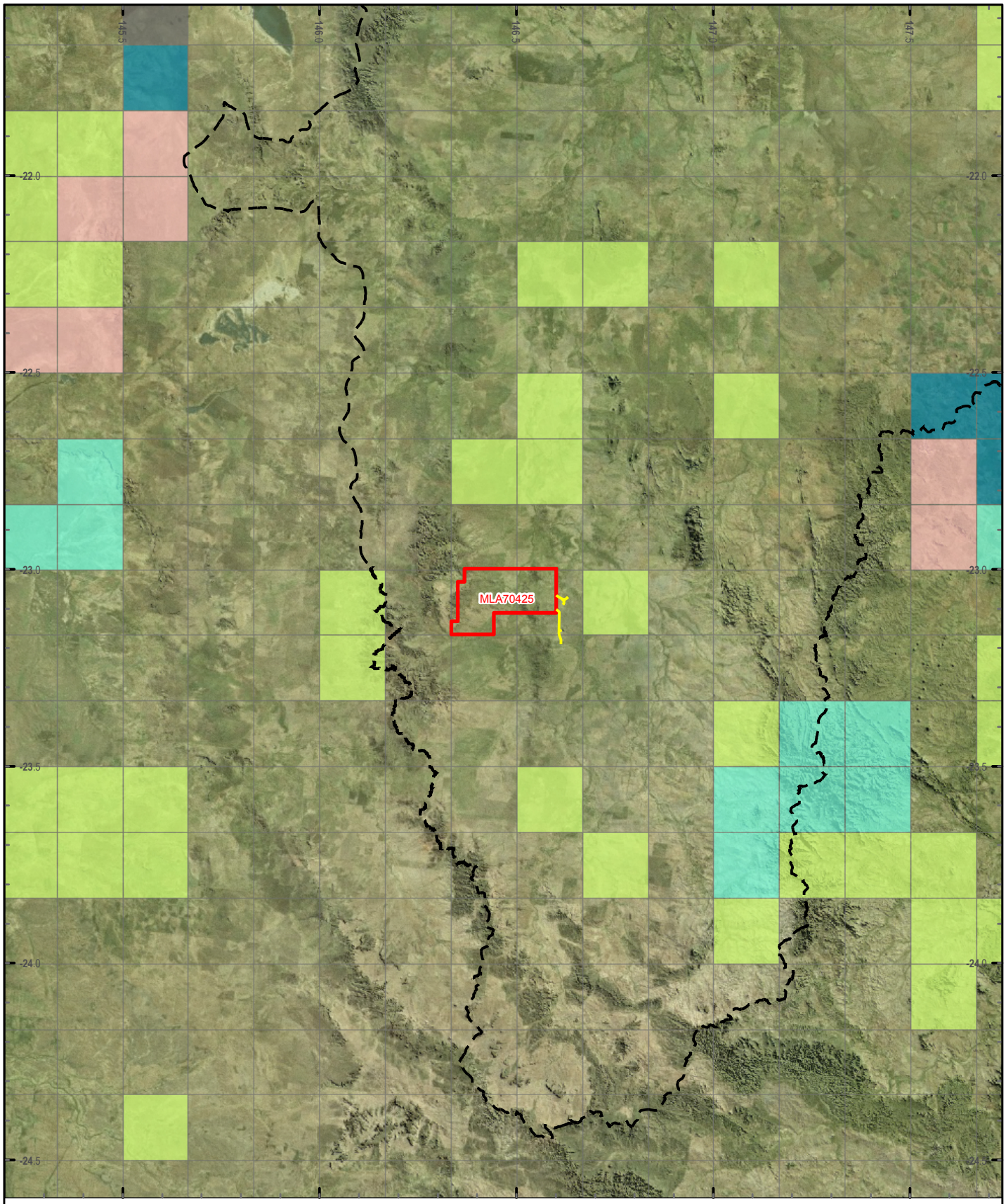
A.2 Rubber Vine



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HANCOCK GALILEE PTY LTD
Kevin's Corner Project
Supplementary Environmental Impact Statement

PEST DISTRIBUTION SURVEY 2009: RUBBER VINE *(Cryptostegia grandiflora)*

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PEST AND WEED MANAGEMENT PLAN

Figure: **A.2**

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Fact sheet

DECLARED CLASS 2 PEST PLANT

Rubber vine

Cryptostegia grandiflora

Rubber vine's ability to quickly spread and colonise areas makes it a threat to many areas of northern Australia. Due to this ability, rubber vine is listed as a Weed of National Significance.

Rubber vine generally invades waterways first, where the seeds germinate in moist silt layers after rain. The plant smothers riparian vegetation and forms dense, sometimes impenetrable, thickets.

This decreases biodiversity and prevents access to both stock and native animals. It also creates habitat for feral animals. Infestations expand outward from waterways, hillsides and pastures, resulting in loss of grazing land and increased difficulty in mustering stock.

Rubber vine is poisonous to stock, though seldom eaten. Most deaths due to rubber vine occur after stock have been stressed, or when other feed is scarce.

PP11 January 2011

Queensland Government

Declaration details

Rubber vine is a declared Class 2 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. Declaration requires landholders to control declared pests on the land and waters under their control. A local government may serve a notice upon a landholder requiring control of declared pests.

Description and general information

Rubber vine is a vigorous climber with twining, whip-like shoots that can grow unsupported as an untidy, multi-stemmed shrub 1–2 m high, or it can scramble up to 30 m high in trees. The stems, leaves and unripe pods exude a white, milky sap when broken or cut.

Leaves are dark green and somewhat glossy, 6–10 cm long, 3–5 cm wide, and in opposite pairs.

Flowers are large and showy, with five white to light purple petals arranged in a funnel shape.

The seed pods are rigid and grow in pairs at the end of a short stalk. The pods are 10–12 cm long, 3–4 cm wide and each can contain up to 450 brown seeds. Each seed has a tuft of long, white, silky hairs, which enable easy dispersal by wind and water.

Life cycle

Rubber vine flowers at any time of year if sufficient moisture is available. Usually, June and July are the only non-flowering months. Plant stem diameter must be approximately 20 mm before flowering can occur.

Seed pod formation occurs from spring to late autumn, with peak seed production corresponding to maximum flowering. Eventually, pods dry out and split open, with pod-splitting occurring approximately 200 days after formation.

Seeds are scattered by wind, but also carried downstream by water. Approximately 95% of seed is viable, although germination requires favourable temperature and soil moisture conditions.

Habitat and distribution

Rubber vine is native to Madagascar, but is now widely distributed throughout tropical and subtropical regions of the world.

The plant was introduced to Australia as an ornamental shrub in 1875 or earlier, and was popular in north Queensland mining settlements due to its luxuriant growth even under harsh conditions. Weedy infestations were recorded around Charters Towers early this century.

Rubber vine prefers areas where annual rainfall is 400–1400 mm, and is well adapted to a monsoonal climate.

Infestations of rubber vine are now found throughout river systems of southern Cape York and the Gulf of Carpentaria, south along the coast to the Burnett River, and isolated infestations occur as far south as Gatton and as far west as the Northern Territory border.

Infestations are common throughout central Queensland, while in western Queensland there are infestations in the Mount Isa, Longreach and Aramac areas. Isolated infestations have been reported in Western Australia.

Control

Effective control of rubber vine can be achieved by a number of methods, alone or in combination depending on the situation and the severity of infestation. All areas treated must be periodically checked and any regrowth treated or the initial treatment efforts will be wasted.

Management strategies

Rubber vine seed is most commonly spread by wind and running water.

It is thus difficult to prevent seed coming onto uninfested land if there is rubber vine anywhere in the area. Your goal should be to prevent rubber vine from establishing and forming dense infestations. It is essential to regularly inspect all areas of your property, paying particular attention to creeks and gullies.

This is most important where prevailing winds are known to blow from infested areas, or where infestations occur upstream.

Any isolated plants located should be treated promptly.

All control of rubber vine will require follow-up treatments to keep your property clean. As rubber vine spreads quickly, small infestations should be controlled first to prevent them from becoming major problem areas. Dense infestations are difficult and costly to treat.

Follow-up treatment must be budgeted for within the overall control program. Techniques need to be integrated for successful rubber vine management. Consideration should be given to coordinating control over a catchment area.

Five suggested strategies for controlling rubber vine in scattered, medium, and dense infestations are outlined in Table 1 (overleaf).

Fire

Rubber vine infestations can be very effectively controlled by burning. Preparing and managing fuel load prior to burning, and following up in a timely manner after the fires, are critical to the overall success of the program.

It is recommended that you perform two successive annual burns. The first fire will open up the infestation to increase grass growth (fuel load) while killing rubber vine plants. The second fire will clean up the regrowth that occurs after the first fire.

An appropriate fire regime is an effective tool for managing rubber vine over the long term, as well as being an effective follow-up to other control methods.

For further information contact 13 25 23.

Biological control

Two biological control agents are successfully established, and their impact depends on abundance. Both agents cause abnormal defoliation, creating an 'energy sink', which appears to reduce seed production. These agents usually do not kill established rubber vine plants.

Diseases

Rubber vine rust (*Maravalia cryptostegiae)* is established over a wide area. Yellow spores form under the leaves and are spread mainly by the wind.

It is most active over summer, abundance being directly related to leaf wetness, which is dependent on rainfall and dew. Over summer, a generation is completed every seven days. Rust activity is reduced over the dry season.

Continued heavy infection causes defoliation, appears to reduce seed production, can kill small seedlings and causes dieback of the whip-like stems. Established plants are not killed.

Insects

Also established is the moth *Euclasta whalleyi*, whose larvae are leaf feeders. Observation indicates the moth prefers stressed plants, either from limited soil moisture or high levels of rust infection.

The moth's period of activity is the dry season. A native fly parasite and a disease can reduce the localised abundance of the *Euclasta* larvae.

The larvae are tapered at both ends, grow up to 30 mm long, and are grey-brown with orange dots along their sides. Fine silken threads and black, bead-like droppings are often found near the larval feeding damage.

The creamy-brown moths are active at night and rest at a 45˚ angle from a surface, with their wings folded. The life cycle from egg to adult takes 21–28 days.

Defoliation reduces the smothering effect on other vegetation and causes an increase in leaf litter and promotes increased grass growth amongst rubber vine, increasing fuel loads required for fire management. Decreased flower and pod production should reduce the ability of rubber vine to spread.

Biological control is also important because it impacts on other control methods.

Mechanical control

Several mechanical techniques are effective in controlling rubber vine. The type of infestation will determine the technique required.

- Scattered or medium-density infestations: Where possible, repeated slashing close to ground level is recommended.
- Dense infestations: During winter, stick-raking or blade-ploughing reduces the bulk of the infestation. Pasture should be sown and windrows burned to kill residual seed. Follow-up treatment is essential. It is important to comply with the relevant state and/or local government native vegetation legislation, and it should be noted that causing even accidental death of vegetation can be a breach of this legislation.

Herbicide control

Herbicides recommended for use on rubber vine are listed in Table 2 (overleaf). Preference ratings (taking account of effectiveness and cost) are shown.

Aerial application

Three herbicides are currently registered for aerial application (refer to Table 2). Two of these are foliar herbicides and the other is a soil-applied herbicide. As a result, the necessary conditions that apply to foliar and soil applications is also applicable to the respective chemical when aerially applied.

People considering aerial application are advised to contact 13 25 23 for current advice on use of this technique.

Foliar spray

The following points should be followed carefully:

- There must be little to no rust present as it affects the health of the plant and its ability to take chemical up through its leaves.
- It is critical that plants be actively growing and NOT water-stressed, yellowing or bearing pods.

- A wetting agent should be used with foliar herbicides.
- Thoroughly spray bushes to the point of run-off, wetting every leaf.
- Avoid spraying when hot and dry (e.g. over 35 °C), or when windy—especially with Agricrop Rubber Vine Spray.
- Foliar spraying is most effective on plants less than 2 m high; large plants with a stem diameter greater than 8 cm may not be killed.

Basal bark spray

This method gives a high level of control although it is not as effective on multi-stemmed plants as it is difficult to spray each stem completely around the base.

Thoroughly spray around the base of the plant to a height of 20–100 cm above ground level, spraying higher on larger plants.

Optimum results are attained when the plant is actively growing.

Cut stump treatment

This is the most successful method of chemical control, but also the most labour intensive. The following points should be followed carefully:

- Cut the stem off as close to the ground (within 15 cm) as possible; for smaller plants use a machete or similar; larger plants may require a chainsaw.
- Make sure the cut is horizontal.
- Immediately spray or swab the cut surface.
- A cost-effective method for scattered to medium-density infestations is the use of a brush-cutter.

Soil application

Because of the high risk of killing non-target vegetation, including trees and pasture plants, soil-applied herbicides play a role in controlling rubber vine only in specific situations.

It is important to comply with the relevant state and/or local government native vegetation legislation, and it should be noted that causing even accidental death of vegetation can be a breach of this legislation.

The following points should be followed carefully:

- Do not use residual herbicides within a distance of two or three times the height of desirable trees.
- Do not use Graslan along waterways or land with greater than a 20° slope.
- A minimum of 50–80 mm of rainfall is required before residual herbicides are taken up by the plant.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Figure 1 Rubber vine containment line and distribution map

Table 1 Suggested strategies for the control of rubber vine

Situation	Initial treatment	Follow-up	Comments
Scattered infestations	Basal bark/ cut stump	Follow-up with basal bark/cut stump as necessary	Cut stump method preferred where possible.
	Foliar spray	Follow-up basal bark/cut stump/ foliar spray as necessary	Only foliar spray when there is nil to little rust on the leaves of the plants.
	Fire	Follow-up basal bark/cut stump/ foliar spray as necessary	For scattered infestations usually recommended only if herbicides not desired, or if have other weeds can be controlled by fire or if fire is utilised to improve pastures.
	Repeated slashing	As above	
Medium infestations	Foliar spray	Treat regrowth, seedlings with basal bark/cut stump/foliar spray	Fire and follow-up with basal bark/cut stump/ foliar spray as necessary.
	Fire	Fire 1 year later and follow-up basal bark/cut stump/foliar spray as necessary	If fuel load is sufficient. CAUTION: There are some native tree species which are susceptible to fire. Check before burning.
	Repeated slashing	As above	
Dense infestations—previously cleared areas	Stick rake or blade plough	Sow pasture ▸ basal bark/foliar spray ▸ fire and basal bark/cut stump/foliar spray as necessary	First treatment clears bulk of rubber vine and kills roots; any regrowth or seedlings can then be treated; when grass growth allows fuel build up, fire used as control and individual plants later treated.
	Fire	Fire 1 year later and follow-up basal bark/cut stump/foliar spray as necessary	If fuel load is sufficient. CAUTION: There are some native tree species which are susceptible to fire. Check before burning.
	Aerial spray	Fire 1–2 years later OR follow-up with basal bark spray	Bulk of rubber vine killed with aerial spray; allow build up of fuel for fire or treat remaining plants with basal bark spray. Contact 13 25 23 before use of method.
	Graslan		Where situation and soil type are suitable.
Dense infestations—along creeks and rivers	Basal bark/ cut stump	Fire OR basal bark/cut stump/ foliar spray	When bulk of rubber vine killed, allow fuel build up for fire or treat remaining plants individually.
	Fire and sow pasture	Fire 1 year later and follow-up basal bark/cut stump/foliar spray as necessary	If there is a sufficient fuel load to carry a fire, it can open up dense infestations. CAUTION: There are some native tree species which are susceptible to fire. Check before burning.

PR11–5580

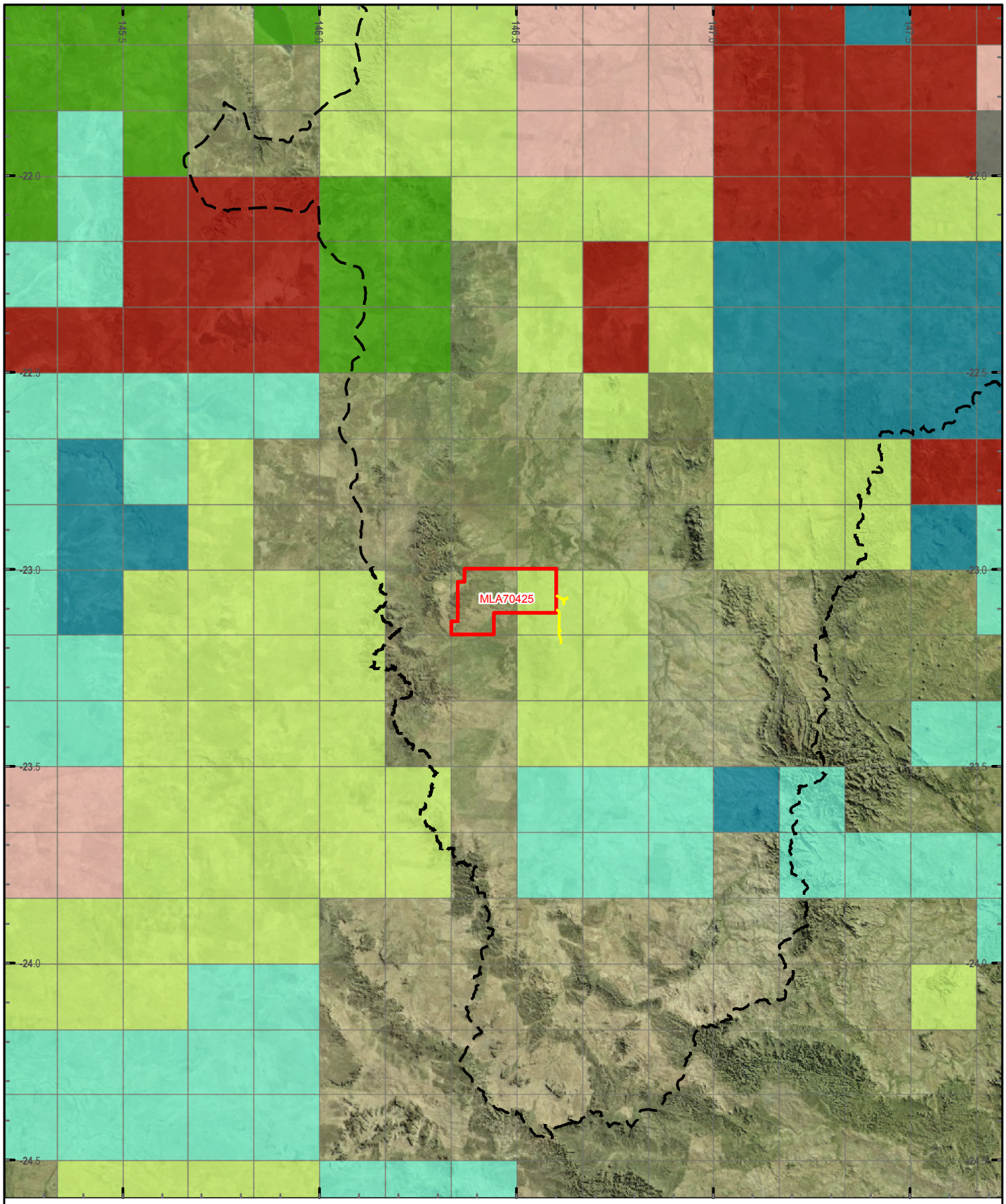
Table 2 Herbicides registered for the control of rubber vine

Situation	Herbicide	Pref. *	Rate	Optimum stage and time	Comments
1. Foliar (overall) spray (ground)	Triclopyr + picloram (Grazon DS, Grass-up, etc.)	1	0.35–0.5 L /100 L water	During active growth	May damage pasture legumes.
	Dicamba (200 g/L) + 2,4-D Ester 800 g/L	1	0.35–0.7 L /100 L water + 175 ml 2, 4-D Ester	As above	As above. Apply in autumn during active growth.
	Metsulfuron methyl (e.g. Brush-off®, Brushkiller™ 600, etc.)	1	15 g/100 L water	As above	Wetting agent is critical. Complete coverage is essential. May damage pasture legumes.
	2,4 D + picloram (Tordon 75-D)	2	1.3 L/100 L water	As above	Thoroughly wet leaves and soil around base of plant.
	2,4-D Ester (Agricrop Rubber Vine Spray)	3	0.5 L/100 L water + activator	As above	May damage pasture legumes; less effective than other treatments, but also much cheaper.
2. Basal bark	2,4-D Ester (Agricrop Rubber vine spray)	1	2.5 L/100 L diesel	Plants actively growing	Thoroughly spray around base of plant.
	Triclopyr + picloram (Access)	1	1 L/60 L diesel	Anytime	
	Triclopyr (eg Garlon 600, Invader 600®, etc.)	1	1 L/60 L diesel	Anytime	
3. Cut stump	2,4-D Ester (Agricrop Rubber Vine Spray)	1	2.5 L/100 L diesel	Anytime	Immediately swab/spray cut surface and base of stem.
	Triclopyr + picloram (Access)	1	1 L/60 L diesel	As above	As above.
	Triclopyr (e.g. Garlon 600, Invader 600®, etc.)	1	1 L/60 L diesel	Anytime	
	2,4 D + picloram (Tordon 75-D)	2	1.3 L/100 L water	As above	As above.
	2,4-D Amine (500 g/L)	2	2 L/100 L water	As above	As above. Less effective than other treatments. Repeat applications may be required.
4. Soil application#	Hexazinone# (Bobcat® SL, Velpar® L)	1	1–4 ml/spot or 6 ml/vine or bush	Prior to rain	See warning below.# Must place spots around bush. Less effective on sandy soils.
	Tebuthiuron# (Graslan)	1	1.5 g/m2	As above	As above; application by hand or backpack spreader.
5. Aerial application	Triclopyr + picloram (Grazon DS, Grass-up, etc.)	1	3–5 L/ha	Plants actively growing	Before aerial application contact 13 25 23.
	Tebuthiuron# (Graslan)	1	7.5–15 kg/ha	Prior to rain	As above.
	2,4-D Ester (Agricrop Rubber Vine Spray)	3	0.5 L/100 L water + activator	Plants actively growing	As above.

* Preference rating— takes account of effectiveness and cost

WARNING: Soil testing is highly recommended prior to application of these herbicides, as rate and efficacy are dependant on soil type.
DO NOT USE SOIL APPLIED HERBICIDES (HEXAZINONE AND GRASLAN) WITHIN A DISTANCE OF TWO TO THREE TIMES THE HEIGHT OF DESIRABLE TREES. DO NOT USE GRASLAN NEAR WATERWAYS OR LAND WITH GREATER THAN A 20° SLOPE.

A.3 Parkinsonia



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Supplementary Environmental Impact Statement

PEST DISTRIBUTION SURVEY 2009: PARKINSONIA *(Parkinsonia aculeata)*

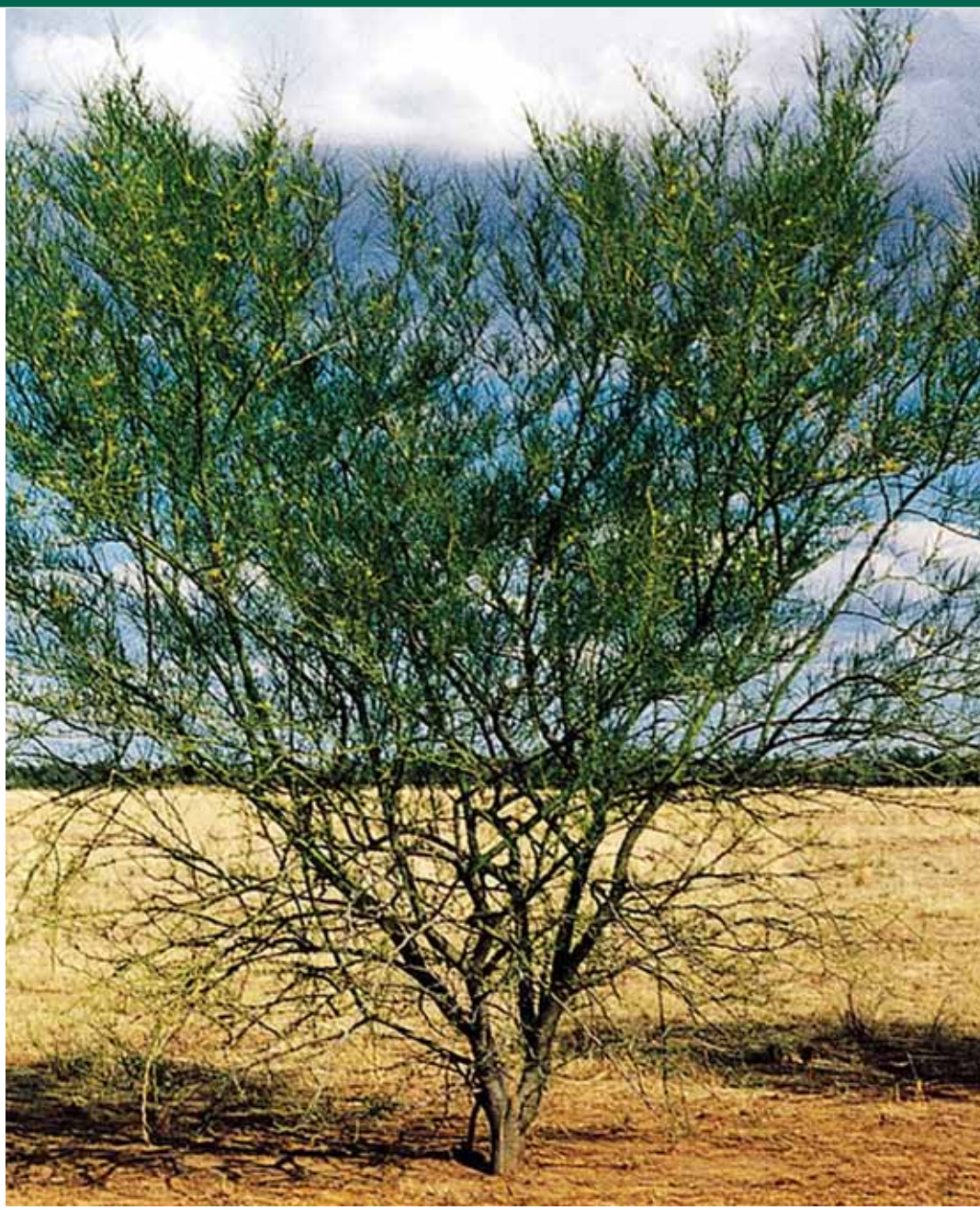
Fact sheet

DECLARED CLASS 2 PEST PLANT

Parkinsonia

Jerusalem thorn or jelly bean tree

Parkinsonia aculeata



Parkinsonia is thought to be native to tropical America but has spread throughout the world as an ornamental and shade tree. It has been recognised in Australia as a Weed of National Significance.

Declaration details

Parkinsonia is a declared Class 2 plant under *Land Protection (Pest and Stock Route Management) Act 2002*. Declaration requires landholders to control declared pests on the land and waters under their control. A local government may serve a notice upon a landholder requiring control of declared pests.

WEEDBUSTERS

Queensland Government

PP36 June 2011

Description and general information

Size and appearance

A hairless shrub or small tree that rarely grows any more than 10 m high, Parkinsonia has slender green photosynthetic zigzag branches armed with sharp spines.

Leaves

Its leaves have a short, spine-tipped stalk, with leaf branches 20–40 cm long, flattened with small, oblong leaflets along each edge.

Flowers

Parkinsonia flowers are yellow, fragrant, five petalled, each on a long, slender drooping stalk. Seeds are oval and hard, about 15 mm long, and borne in pencil-like pods 5–10 cm long, constricted between the seeds.

Lifecycle

Parkinsonia is fast growing and may flower in early summer of its second or third year of growth. Once established, flowering can occur opportunistically to exploit variable seasonal conditions. Pods mature in late summer, float on water and hence are readily dispersed by flood waters.

Under favourable warm and wet field conditions, most seeds germinate within 2 years. However, a small proportion of seed may remain dormant for longer periods if it's under heavy pasture cover, buried deeper in the soil profile, when inundated or when insufficient rain has fallen.

Habitat and distribution

As parkinsonia is adapted to an extremely wide range of soil types, there is little doubt that it will continue to spread through watercourses and adjoining areas throughout the sub-humid and semi-arid environments of Queensland.

The most vulnerable areas are the lower Gulf of Carpentaria region, Lake Eyre catchment especially the Channel country, Central Highlands and Cape York.

Control

Biological control

Three species of insects have been introduced into Australia as biological control agents against parkinsonia.

Parkinsonia seed beetles *Penthobruchus germaini* and *Mimosetes ulkei*.

Both *Penthobruchus germaini* and *Mimosetes ulkei* are seed beetles that attack only parkinsonia and whose larvae destroy mature parkinsonia seeds.

Penthobruchus germaini is a small (5 mm – 6 mm long) brown beetle from Argentina. It was first released in 1995 and has established much more readily than *Mimosestes*. It has established readily at all release sites and spreads rapidly.

Penthobruchus can exert heavy pressure on parkinsonia seeds in some areas. In the field its presence is indicated by white eggs against a darker background of the pods. Round holes in the pods indicate that beetles have emerged.

Mimosestes ulkei is a small (about 5 mm long) two-tone grey beetle from the USA. While it is established at several sites, it does not establish as readily as *Penthobruchus*. It has potential to contribute to the destruction of parkinsonia seeds. In the field, round emergence holes are the only external indication of its presence.

Parkinsonia leaf bug *Rhinacloa callicrates* *Rhinacloa callicrates* is a small green bug (about 3 mm long) imported from the USA. It feeds on leaves and shoots of parkinsonia resulting in tiny round white spots where it destroys photosynthetic tissue. It is well established in Queensland but it has no significant impact on parkinsonia.

Further biological control studies

Research has continued in recent years to survey the native range of parkinsonia for potential new agents. Several prospective insects have been identified and will be subject to host-testing studies prior to release.

Dieback research

Naturally occurring fungal pathogens have been identified as causing dieback within many infestations of parkinsonia across Northern Australia. Studies are continuing regarding the use of these pathogens as biological control tools.

Mechanical control

Initial clearing by stick raking, blade ploughing or ripping is effective, however:

- it is restricted to reasonably level areas away from watercourses
- clearing will hasten seed germination, necessitating follow-up control either mechanically or chemically.

Establishing improved pasture will aid in managing parkinsonia by competition.

Fire

Fire may be a useful tool for the management of parkinsonia infestations. Kill rates may vary from 30% to 90% with best results obtained from slow moving fires.

Fire will destroy seedlings if sufficient fuel load is present, but mature plants will usually survive.

Herbicide control

Herbicides registered for the control of parkinsonia are listed in Table 1.

Aerial application

Aerial application is undertaken by purpose-built applicators by helicopter. This is useful for dense, strategic infestations although it may be expensive on a broad scale.

Foliar (overall) spray

This is an effective control method for seedlings up to 1.5 m tall. Spray leaf and stems to point of runoff. A wetting agent must be used.

Basal bark spray

For stems up to 15 cm diameter, carefully spray around the base of the plant to a height of 30 cm above ground level. Larger trees may be controlled by spraying to a greater height, up to 100 cm above ground level.

Plants should be actively growing and preferably flowering. Field experience has shown that good soil moisture is essential for effective control.

Because parkinsonia infested areas are often subject to flooding, care is needed to ensure mud and flood debris does not prevent spray penetration to the bark. The trunk may need to be cleared before spraying. Addition of petrol or A-1 jet fuel will aid penetration.

Cut stump treatment

Cut stump treatment may be performed at any time of the year. Cut stems off horizontally as close to the ground as possible. Immediately (within 15 seconds) swab or spray the cut surface and associated stem with herbicide mixture.

Soil application

Use one dose of herbicide per metre of tree height. Place doses close to tree trunk, either with spot gun on clear bare ground, or underground with ground injector. Rain or sufficient soil moisture is required before herbicide is taken up by the plant.

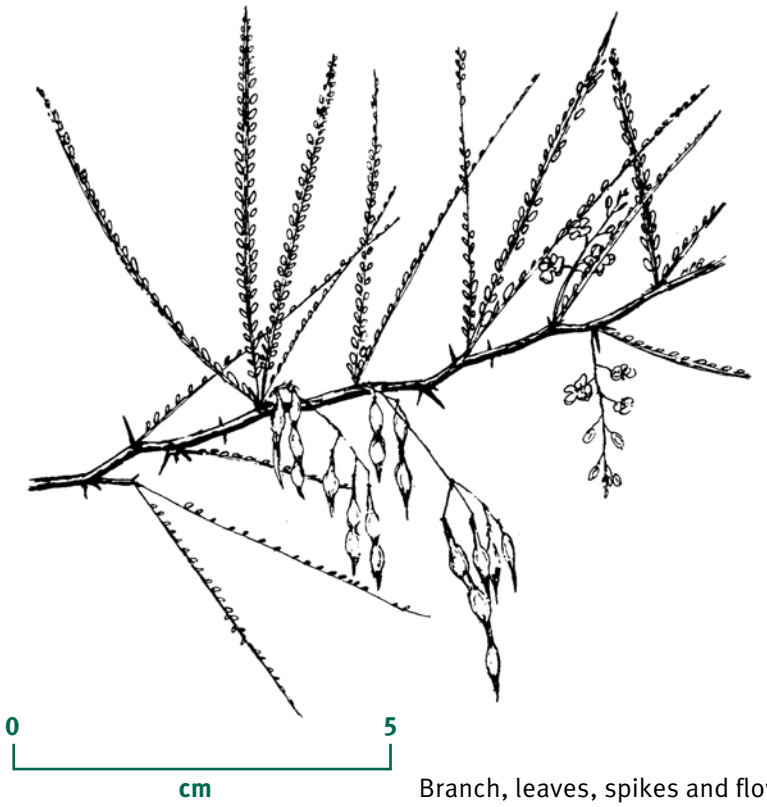
Do not use near watercourses or within a distance equal to at least twice the height of desirable trees.

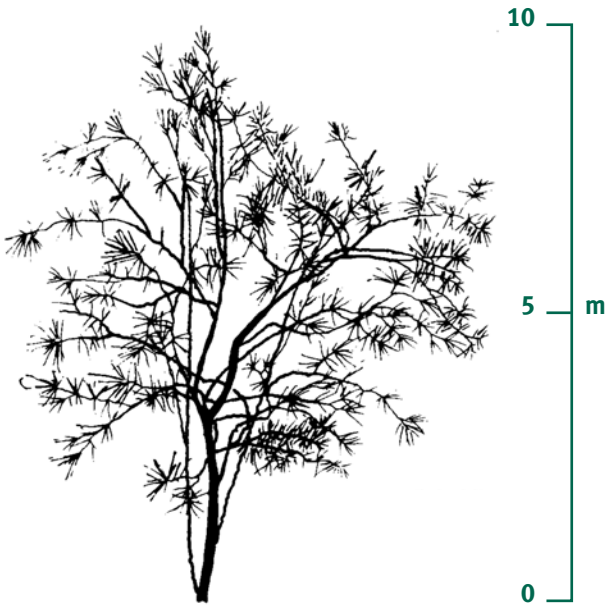
Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Table 1 Herbicides registered for the control of parkinsonia.

Situation	Herbicide	Rate	Optimum stage and time	Comments
Aerial application	Aminopyralid, picloram and tricopyr e.g. Grazon Extra DS®	3 L/ha	Seedlings 1–2 m tall, or 12–24 months old	Application by helicopter only. Addition of 1 L/ha of Uptake® wetting agent
Foliar (overall spray)	Aminopyralid, picloram and tricopyr e.g. Grazon Extra DS®	0.35 L/100 L water	Seedlings less than 2 m tall and actively growing	Wet plant thoroughly. Use wetting agent
Basal bark spray	Triclopyr and picloram e.g. Access®	1 L/60 L diesel	As above. Stems up to 5 cm diameter	Do not treat wet stems
Cut stump	Triclopyr and picloram e.g. Access®	1 L/60 L diesel	Any time of year	Cut close to ground level and treat **immediately**
Soil application	Hexazinone e.g. Velpar L® (via spotgun)	4 ml per spot—1 spot for each shrub/tree	Any time, but needs moisture to activate chemical	Shrubs/trees up to 5 m tall
	Tebuthiuron e.g. Grazon Extra DS®	1 to 1.5 g/m^2	Any time, but needs moisture to activate chemical	Refer to label for critical comments

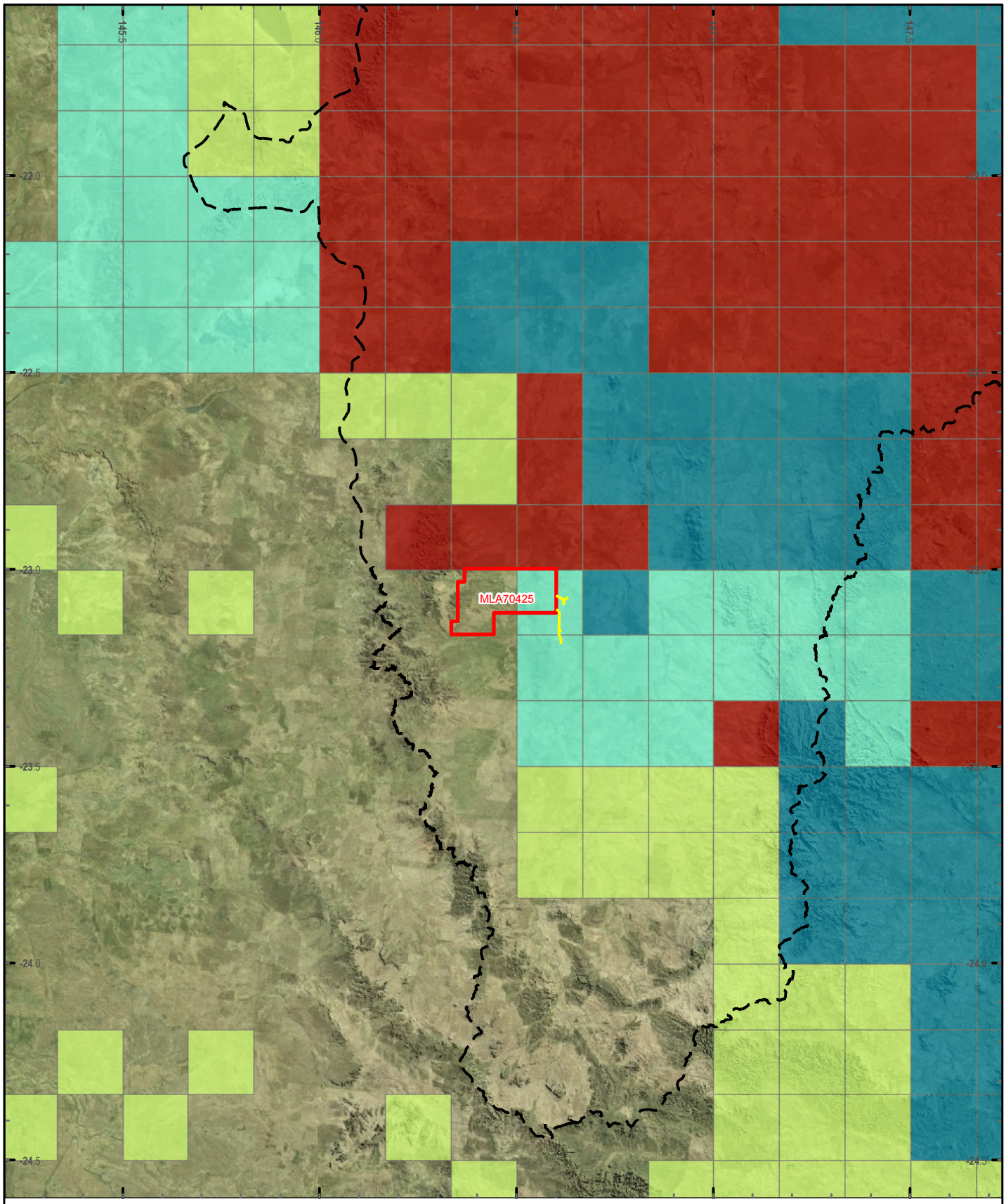




Branch, leaves, spikes and flowers

CS0480 06/11

A.4 Parthenium



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Supplementary Environmental Impact Statement

PEST DISTRIBUTION SURVEY 2009: PARTHENIUM *(Parthenium hysterophorus)*

URS

PEST AND WEED MANAGEMENT PLAN

Figure: **A.4**

File No: **42626920-g-2052.mxd** Drawn: **XL** Approved: **KM** Date: **30-08-2012** Rev. **B** A4

Fact sheet

DECLARED CLASS 2 PEST PLANT

Parthenium weed

Parthenium hysterophorus

Parthenium costs the beef industry a total of $16.5 million per year and cropping industries several million dollars per year.

Declaration details

In Queensland, Parthenium is a Class 2 declared plant.

Under the *Land Protection (Pest and Stock Route Management) Act 2002*, Class 2 declaration requires landholders to control pests on the land and waters under their control. A local government may serve a notice upon a landholder requiring control of declared pests.

WEED BUSTERS

Queensland Government

PP2 June 2011

Description and general information

Size

Parthenium weed is an annual herb with a deep tap root and an erect stem that becomes woody with age. As it matures, the plant develops many branches in its top half and may eventually reach a height of two metres.

Leaves

Its leaves are pale green, deeply lobed and covered with fine soft hairs.

Flowers

Small creamy white flowers occur on the tips of the numerous stems. Each flower contains four to five black seeds that are wedge-shaped, two millimetres long with two thin, white scales.

Lifecycle

Parthenium weed normally germinates in spring and early summer, produces flowers and seed throughout its life and dies around late autumn. However, with suitable conditions (rain, available moisture, mild temperatures), parthenium weed can grow and produce flowers at any time of the year. In summer, plants can flower and set seed within four weeks of germination, particularly if stressed.

Potential damage

Parthenium weed is a vigorous species that colonises weak pastures with sparse ground cover. It will readily colonise disturbed, bare areas along roadsides and heavily stocked areas around yards and watering points. Parthenium weed can also colonise brigalow, gidgee and softwood scrub soils. Its presence reduces the reliability of improved pasture establishment and reduces pasture production potential.

Parthenium weed is also a health problem as contact with the plant or the pollen can cause serious allergic reactions such as dermatitis and hay fever.

Habitat and distribution

Parthenium weed is capable of growing in most soil types but becomes most dominant in alkaline, clay loam soils.

The plant is well established in Central Queensland and present in isolated infestations west to Longreach and in northern and southern Queensland.

Infestations have also been found in northern and central parts of New South Wales and it is capable of growing in most states of Australia.

Control

Prevention and weed seed spread

As with most weeds, prevention is much cheaper and easier than cure. Pastures maintained in good condition, with high levels of grass crown cover, will limit parthenium weed colonisation. Drought, and the subsequent reduced pasture cover, creates the ideal window of opportunity for parthenium weed colonisation when good conditions return.

Parthenium seeds can spread via water, vehicles, machinery, stock, feral and native animals and in feed and seed. Drought conditions aid the spread of seed with increased movements of stock fodder and transports.

Vehicles and implements passing through parthenium weed infested areas should be washed down with water. Wash down facilities are located in Alpha, Biloela, Charters Towers, Emerald, Gracemere, lnjune, Monto, Moura, Rolleston, Springsure and Taroom. Particular care should be taken with earthmoving machinery and harvesting equipment. The wash down procedure should be confined to one area, so that plants that establish from dislodged seed can be destroyed before they set seed.

Extreme caution should be taken when moving cattle from infested to clean areas. Avoid movement during wet periods as cattle readily transport seed in muddy soil. On arrival, cattle should be held in yards or small paddocks until seed has dropped from their coats and tails prior to their release into large paddocks. Infestations around yards can be easily spotted and controlled whereas infestations can develop unnoticed in large paddocks.

Particular care should be taken when purchasing seed, hay and other fodder materials. Always keep a close watch on areas where hay has been fed out for the emergence of parthenium or other weeds.

Property hygiene is important. Owners of clean properties should ensure that visitors from infested areas do not drive through their properties. If your property has parthenium weed on it, ensure that it is not spread beyond the boundary or further within the property.

Pasture management

Grazing management is the most useful method of controlling large-scale parthenium weed infestations. Maintain pastures in good condition with high levels of ground and grass crown cover. This may require rehabilitation of poor pastures, followed by a sound grazing maintenance program.

Sown pasture establishment—Poor establishment of sown pastures can allow parthenium weed colonisation. pasture agronomist Aerial seeding prior to scrub pulling is normally beneficial.

Overgrazing—High grazing pressure caused by drought or high stock numbers decreases the vigour and competitiveness of pastures and allows the entry and spread of parthenium weed. Maintenance of correct stock numbers is most important in controlling parthenium weed. pasture agronomist

Pastures spelling—In situations of serious infestation, pasture spelling is essential for rehabilitation. Total spelling is much more effective than simply reducing the

stocking rate. However, overgrazing of the remainder of the property must be avoided.

The most appropriate time for pasture spelling is the spring–summer growing period, with the first 6–8 weeks being particularly important. If the condition of perennial grasses (native or sown) is low, spelling for the entire growing season may be required or introduced grasses may need to be re-sown. Herbicide treatment can hasten the rehabilitation process by removing a generation of parthenium seedlings and allowing grass seedlings to establish without competition. In the presence of parthenium weed, grass establishment is poor.

Grazing during winter should not increase the parthenium weed risk. Most tropical grasses are dormant and can tolerate moderate grazing during this period. However, parthenium weed may germinate and grow at this time.

Fencing—One of the main problems in controlling parthenium weed is the large paddock size and the variability of country within paddocks. The resulting uneven grazing pressures encourage parthenium weed to colonise the heavily grazed country. Ideally, similar land types should be fenced as single units. Fencing can be used to great effect to break up large paddocks, allowing more flexible management such as pasture spelling or herbicide application, options not available previously.

Burning—Burning is not promoted as a control strategy for parthenium weed. However, research suggests that burning for pasture management (e.g. woody weed control) should not result in an increased infestation if the pasture is allowed to recover prior to the resumption of grazing. Stocking of recently burnt areas known or suspected to contain parthenium decreases pasture competition and favours parthenium, ultimately creating a more serious infestation.

Herbicide control

Non-crop areas—Parthenium weed should be sprayed early before it can set seed. A close watch should be kept on treated areas for at least two years.

Small and/or isolated infestations should be treated immediately. Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. Repeated spraying may be required even within the one growing season to prevent further seed production.

Extensive infestations will require herbicide treatment in conjunction with pasture management. Timing of spraying is critical so that parthenium weed is removed when plants are small and before seeding has occurred. Grasses should be actively growing and seeding so that they can recolonise the infested area.

Table 1 shows the herbicides registered for parthenium weed control and application rates. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

Cropping areas—Controlling parthenium weed in cropland requires selective herbicide use and/or crop rotations. For further information on parthenium weed control in crops consult your local biosecurity officer.

Biological control

The combined effects of biological control agents reduced the density and vigour of parthenium weed and increased grass production.

There are currently a number of insect species and two rust pathogens that have been introduced to control parthenium weed—a selection of these are outlined below.

Epiblema strenuana is a moth introduced from Mexico established in all parthenium weed areas. The moth's larvae feed inside the stem, forming galls that stunt the plant's growth, reduce competitiveness and seed production.

Listronotus setosipennis is a stem-boring weevil from Argentina but is of limited success in reducing parthenium weed infestations.

Zygogramma bicolorata is a defoliating beetle from Mexico which is highly effective where present. It emerges in late spring and is active until autumn.

Smicronyx lutulentus (Mexico) lays eggs in the flower buds where the larvae feed on the seed heads.

Conotrachelus albocinereus (stem-galling weevil from Argentina) produces small galls and is still becoming established in Queensland.

Bucculatrix parthenica (leaf mining moth from Mexico) larvae feed on leaves, leaving clear windows in the leaf.

Carmentia ithacae is a stem boring moth from Mexico which is becoming established at favourable sites in the northern Central Highlands.

Puccinia abrupta is a winter rust from Mexico that infects and damages leaves and stems. It is currently established over a wide area from Clermont south. It requires a night temperature of less than 16 degrees and 5–6 hours of leaf wetness (dew). Sporadic outbreaks occur where weather conditions are suitable.

Puccinia melampodii is a summer rust from Mexico that weakens the plant by damaging the leaves over the summer growing season. It is currently established and spreading at a number of sites from north of Charters Towers to Injune in the south.

Manual control

Hand pulling of small areas is not recommended. There is a health hazard from allergic reactions and a danger that mature seeds will drop off and increase the area of infestation.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Table 1 Herbicides registered for parthenium weed.

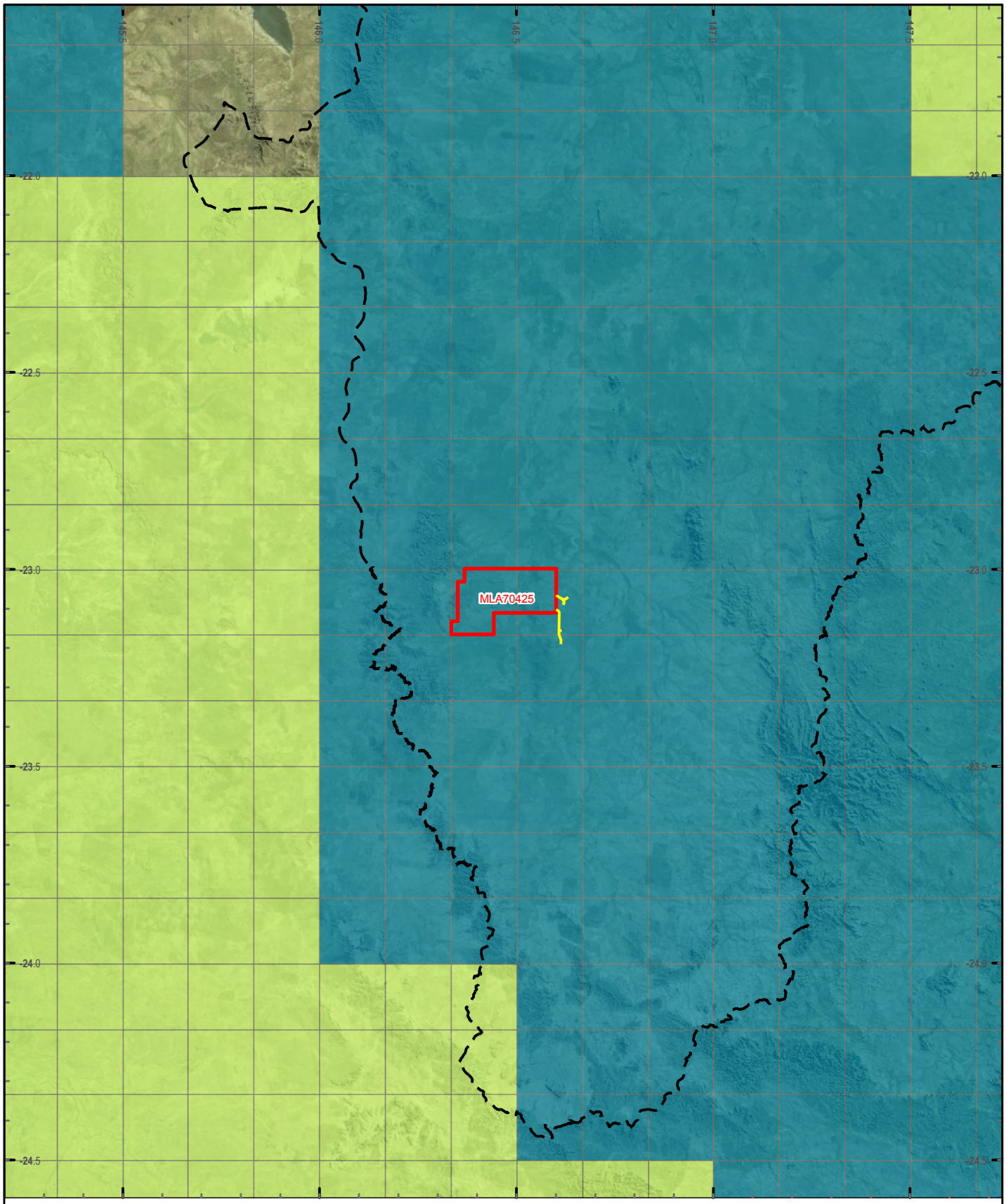
Herbicide	Rate	Situation	Comments
2,4-D amine 500 g/L	0.4 L/100 L	Land—industrial, pastures; rights-of-way	Spot spray
atrazine 500 g/L	3.6–6 L/ha	Fields and fallow	Boom spray
max 3 kg/ha/yr	6 L/ha	Land—industrial, commercial, non-agricultural, roadside, right-of-way	Boom spray
atrazine 900 g/kg	2–3.3 kg/ha	Fields and fallow	Boom spray
max 3 kg/ha/yr	3.3 kg/ha	Land—non-agricultural, commercial, industrial	Boom spray
2,4-D + picloram (Tordon 75-D)	125 ml/100 L	Land—commercial, industrial, pastures, right-of-way	Spot spray
	3 L/ha	Land—commercial, industrial, pastures, right-of-way	Boom spray
2,4-D ester[1]	.025 L/10 L	Land—non-agricultural, pastures	Rosette stage
glyphosate (450 g/L)	0.8–1.2 L/ha	Fields and fallow	Spot spray
metsulfuron methyl	5–7 g/ha	Fields and fallow	Seedlings only
	5 g/100 L	Land—commercial, industrial, pastures, rights-of-way	Spot spray
hexazinone	3.5 L/ha or 7 L/10 L/20 m^2	Land—commercial, industrial, pastures, rights-of-way	Boom spray or spot spray
dicamba (200 g/L)	0.7–2.8 L/ha or 0.1–0.19 L/100L	Grass pastures	Boom spray or spot spray
(500 g/L)	0.28–1.1 L/ha or 0.40–0.76 L/100L	Grass pastures	Boom spray or spot spray
(700 g/kg)	200–800 g/ha or 30–60 g/100 L	Grass pastures	Boom spray or spot spray

[1]Use restricted in some areas of Central Queensland

Notes The registered rates are for non-crop uses. Consult label for in-crop recommendations.
For power hand spray or knapsack use, spray plants to the point of runoff.

CS0564

A.5 Noogoora Burr



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PEST DISTRIBUTION SURVEY 2007: NOOGOORA BURR *(Xanthium occidentale)*

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PEST AND WEED MANAGEMENT PLAN

Figure: **A.5**

File No: **42626920-g-2058.mxd** Drawn: **XL** Approved: **KM** Date: **30-08-2012** Rev. **B** A4

Noogoora burr

Xanthium pungens

Noogoora burr is found along river and creek flats, on roadsides and in pasture land following seasonal rain or floods.

The burrs readily contaminate wool, significantly reducing the value of the wool due to increased processing costs. Thick patches of noogoora burr may deny sheep access to watering points. This plant is also a serious competitor in pastures and summer crops.

Seedlings are poisonous to domestic stock, causing death if eaten in sufficient quantities.

Declaration details

Noogoora burr is not declared under the *Land Protection (Pest and Stock Route Management) Act 2002*; however, it may be declared under local government law and be reflected in the local government area pest management plan.

Landholders are required to control declared pests on the land and waters under their control. A local government may serve a notice upon a landholder requiring control of declared pests.

PP17 June 2011

Description and general information

This plant is an erect, annual herb that can grow up to 2.5 m high. It has blotched purple stems. Leaves are dark green on the upper surface, similar in shape to grape leaves, 15 cm in diameter and roughly textured with minute bristles. Flowers are inconspicuous—both male and female occurring in leaf axils towards the end of the branches. Flowers develop into hard, woody, spiny burrs, 1.2–2 cm long, with numerous hooked spines.

Habitat and distribution

Noogoora burr is widespread in Queensland, occurring in tropical regions and the central and western regions (where it prefers alluvial flood plains).

Control

As this plant is an annual, infestations will be reduced if seeding can be prevented.

Biological control

Some level of control has been achieved with biological control agents including stem-boring and stem-galling insects, and a rust fungus (*Puccinia xanthii*). This form of control has been more effective in tropical areas where temperatures and moisture conditions are favourable.

Mechanical control

Cultivation or hand pulling isolated plants is effective if performed before flowering or burr formation.

Herbicide control

Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label. Details of herbicides registered for the control of noogoora burr are listed in Table 1.

Spraying with 2,4-D or MCPA before flowering will give favourable results. As plants mature, higher rates are necessary.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Table 1 Herbicides registered for the control of noogoora burr

Situation	Herbicide	Rate	Comments
Winter cereals	2,4-D Amine 500	1 L/ha	Boom spray when young
Cotton	Fluometuron 500	1.3–7.2 L/ha	Boom spray when young
Fields/fallow	Glyphosate 450	0.8–1.2 L/ha	Boom spray when young
Fallow crop lands, headlands and drains	Ametryn	720 ml/100 L	Hand spraying for plants up to 60 cm and actively growing
Sorghum	2,4-D Amine 500	0.5–1 L/ha	Boom spray when young
Pastures (grass)	MCPA 500 (Amine)	0.7–4 L/ha	Boom spray when young
Turf, ovals/parks	2,4-D Amine 500	2–4 ml/1 L	Spot spray when young

CS0479 06/11

A.6 Mimosa Bush

No distribution mapping is available for this weed.

Mimosa bush

Acacia farnesiana

Description

Mimosa bush (*Acacia farnesiana*) is a rounded shrub or small tree generally growing 3 m tall, occasionally to 5 m. It often forms thorny thickets, and is nearly always multi-stemmed. The branches grow in a zigzag shape and are usually a grey-brown colour with prominent white spots.

Leaves are a ferny type, with 1−6 pairs of leaf "branches" each with 5−20 pairs of narrow, rounded leaflets 4−8 mm long. Leaves are sometimes more of a yellowish green than a pure green. Thorns are found in pairs at the base of each leaf and can grow up to 10 cm long.

Golden yellow to orangeish flowers are bailshaped, about 1 cm across, and grow on stalks, usually two stalks at the base of each leaf. Flowers develop into clusters of cigar-shaped pods, slightly curved and up to 6 cm long. The pods are dark brown or black and woody at maturity, with seeds embedded in the pith. Pods do no split open and tend to stay on the plant for a length of time.

Mimosa can be confused with the declared weeds mesquite (*Prosopis* spp.) and prickly acacia (*Acacia nilotica*), particularly when young (see the 'Identification of Prickly Bushes' fact sheet).

Produced by: Invasive Plants and Animals, Biosecurity Queensland
Queensland Government

Distribution

Mimosa bush, a native of central and south America, is naturalised in Australia. It is very widespread in Queensland, and found in all but the wettest and driest parts of the State. Seeds sprout readily and plants grow rapidly. It does well in dry localities and on loamy or sandy soils, forming thickets along watercourses. Mimosa bush withstands drought well, is readily eaten by stock, and has good regrowth after grazing. It is not a long-lived plant. In some parts of the world this bush is cultivated for perfume production.

The problem

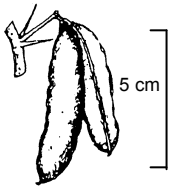
Mimosa bush can spread readily and grow quickly. As it often forms thorny thickets, it can be a considerable nuisance during mustering and can also hinder stock access to water.

Mimosa does offer shade in open downs country and can be useful as a supplement to grass during the dry season. It may therefore be a useful plant in some areas if its spread can be controlled to prevent thicket formation. The maintenance of healthy pasture competition is the best mechanism to achieve this.

Herbicide control

Basal bark spray

For stems up to 15 cm diameter, carefully spray completely around base of plant to a height of 30 cm above ground level. Thoroughly spray into all crevices. Larger trees may be controlled by spraying to a greater height, up to 100 cm above ground level.



The best time for treatment is during autumn when plants are actively growing and soil moisture is good.

Cut stump treatment

At any time of year, cut stems off horizontally as close to the ground as possible. **Immediately** (within 15 seconds) swab cut surface with herbicide mixture.

Bore drains

Channels and drains must be empty of water. Spray a one metre strip into the mud in channel or drain. Wait at least three days for diuron to bond to mud before slowly allowing water in again. Water must not be used in domestic water supply or supplied to desirable shade trees for 7−14 days after re-opening the drain.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

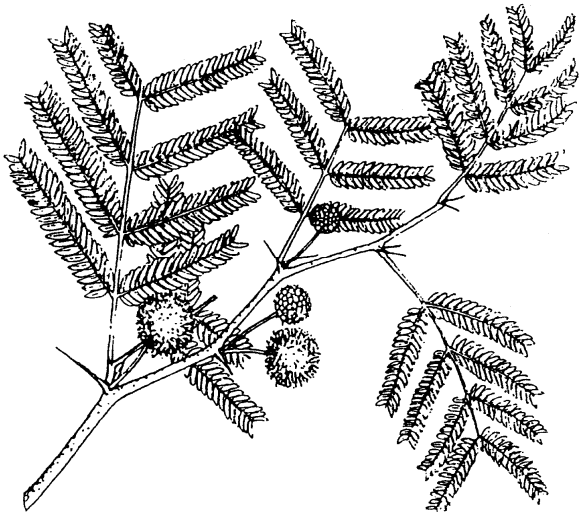


TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF MIMOSA BUSH

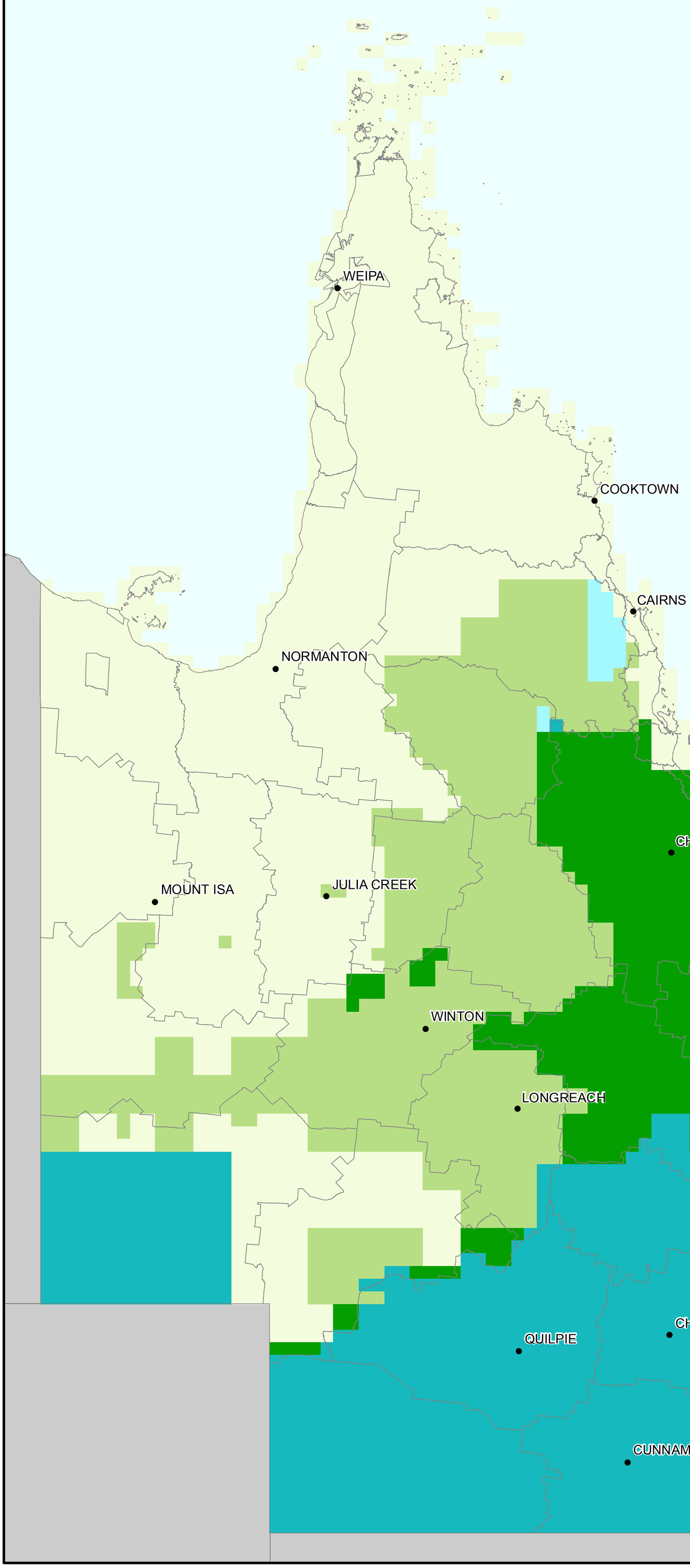
	Herbicide	Rate		Remarks (also see text)
Basal bark/cut stump	Fluroxypr eg. Starane 200®, Tomigan 200 EC®, Flagship 200®.	3 L/100 L diesel	Basal bark: for plants up to 5cm basal diameter.	
	Triclpyr + picloram eg. Access®	1 L/60 L diesel	Basal bark: for plants up to 5 cm basal diameter.	Ensure all stems on multi-stemmed plants are treated.

A.7 European Rabbit

RABBIT

(Oryctolagus cuniculus)

QUEENSLAND DISTRIBUTION 2008



Queensland Government
Department of Primary Industries and Fisheries

APDS 2008

Density	*Distribution* Widespread	Localised
Abundant		
Common		
Occasional		

Absent

Unknown

LGA boundary

N

Digital data supplied by: Department of Primary Industries & Fisheries (DPI&F)

Map produced: Pest Information Management, Biosecurity Queensland, DPI&F

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PESTINFO

Fact sheet

DECLARED CLASS 2 PEST ANIMAL

The rabbit and its control

Oryctolagus cuniculus

Declaration details

The rabbit is a declared Class 2 animal under the *Land Protection (Pest and Stock Route Management Act) 2002*.

Description and general information

Rabbits are one of Australia's major agricultural and environmental animal pests, costing the country between $600 million and $1 billion annually. They compete with native animals, destroy the landscape and are a primary cause of soil erosion by preventing regeneration of native vegetation.

Pet rabbits

Introducing and selling rabbits in Queensland is not permitted (max. penalty $40 000). Limited numbers of permits for domestic rabbits are only available from Biosecurity Queensland for research purposes, public display, magic acts or circuses. Before a permit is granted, a number of guidelines need to be fulfilled.

Habitat

Rabbits are adaptable and sometimes live in close association with people. They live in built environments such as:

- in and under buildings
- old machinery and storage containers
- in old dumps.

In rural environments rabbits frequently live in:

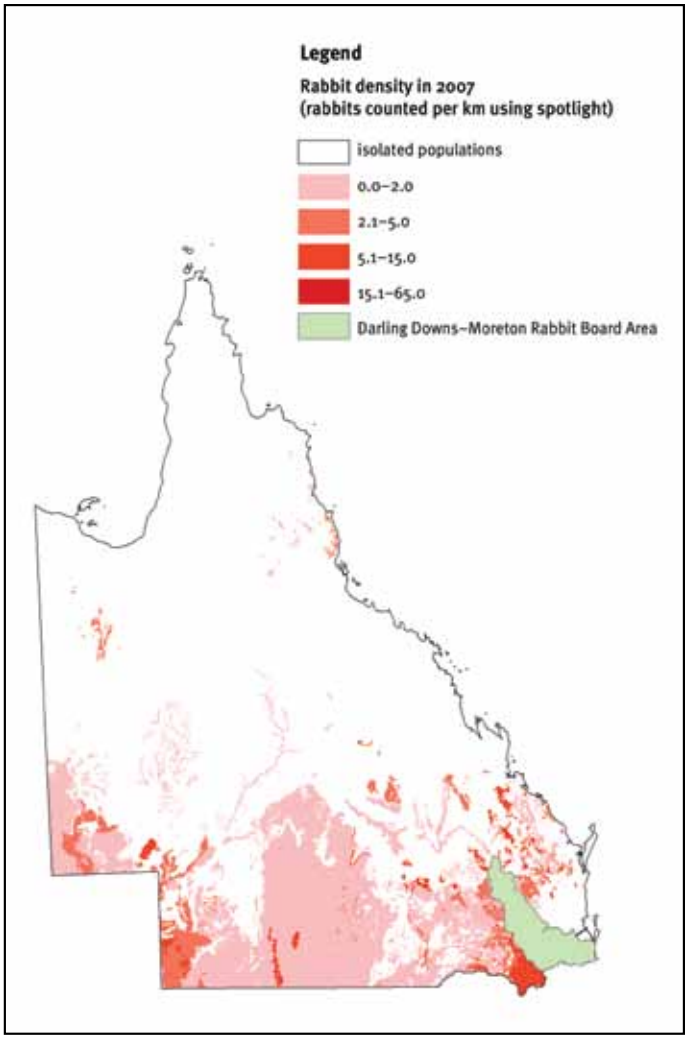
- felled timber and associated windrows
- tussock grasses and rocky areas
- warrens (if soils are easy to dig).

Rabbit warrens

Rabbits prefer to live in warrens as protection against predators and extremes in temperature. However, they will survive in above-ground harbours such as logs, windrows and dense thickets of scrub (e.g. blackberry and lantana) or under built harbour, old sheds and machinery etc. In newly colonised areas without warrens, rabbits tend to live in 'scrapes' (or 'squats').

Queensland Government

PA11 July 2010



Number of rabbits likely to be seen with a spotlight at night. Darker areas indicate more suitable rabbit habitat

Breeding

Does (females) are pregnant for 28–30 days, but are able to mate within hours of giving birth. The average litter is 3–4 kittens but varies from two in a young doe, up to eight or more in a mature doe, and depends on the amount and quality of food available. Five to six litters are possible in a good season.

Young does can breed at four months of age if conditions are suitable.

Where to start control

For effective long-term rabbit control, concentrate on destroying source areas. Source areas will all have well-established warrens or ready-made structures that are cool and provide protection from predators. A source area must also have a good supply of green feed during the cooler seasons.

Rabbits on a warren

Coordinating control

Rabbit control is best done as a joint exercise involving all land mangers in the district. Cost-effective, long-term results can be achieved in rabbit control by following the methods outlined below.

Effective rabbit control cycle

Control

Integrated control

Landholders should adopt an integrated control approach, incorporating appropriate strategies from those listed below. Landholders must understand that biological control agents such as myxomatosis and rabbit hemorrhagic disease virus (RHDV) are not a complete solution to rabbit problems. It is essential to incorporate them into a management strategy with other control techniques.

RHDV offers landholders a major opportunity to reduce rabbit numbers; however, failure to combine RHDV with other control strategies could cause rabbit immunity to develop (as occurred with myxomatosis).

Destroying a rabbit's home (e.g. warren) is the most effective method for long-term control.

Conventional control methods, such as fumigating, ripping warrens and harbour destruction, are essential for the continued long-term reduction of rabbit numbers.

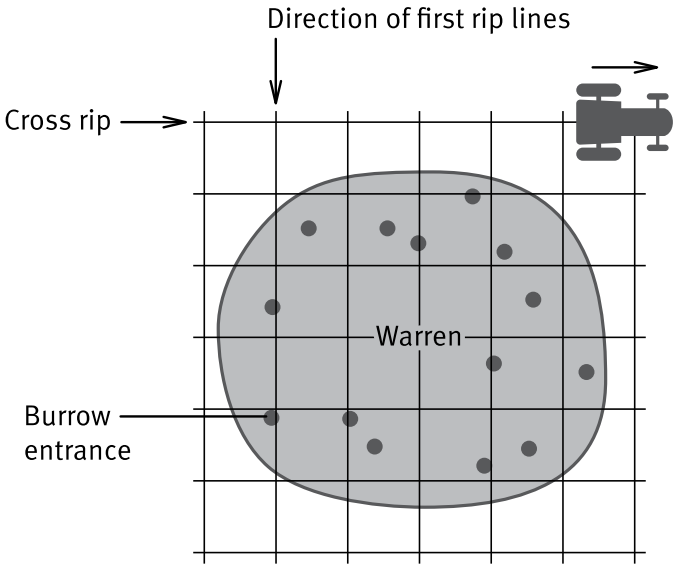
Warren ripping

In areas where rabbits live in warrens, ripping is the most effective method of long-term control. Ripping is so successful because warrens can rarely be reopened and rabbits are unable to recolonise these areas.

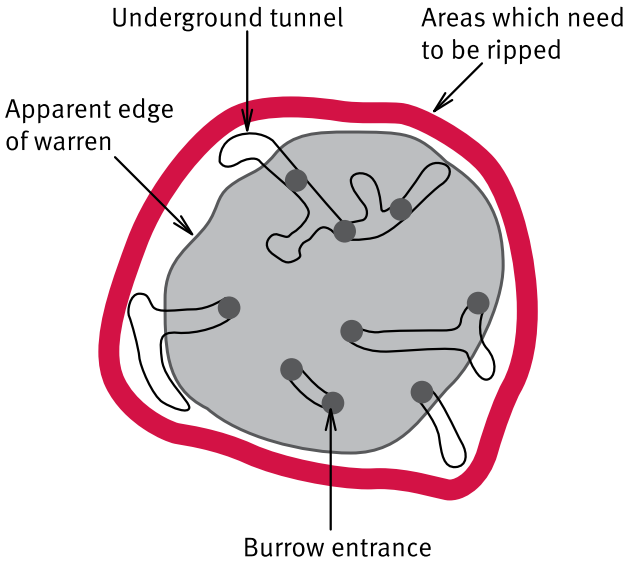
Tyne for ripping warrens (photo courtesy Mark Ridge)

To get the best results it is important to chase as many of the rabbits inside the warren as possible. Dogs can be used to drive rabbits into the warren before ripping starts.

The aim of ripping is to completely destroy the warren. It involves using a tractor with a tyned (sharp-pronged) implement—one tyne or many—that rips through the warren and collapses it. Larger tractors and dozers are more appropriate for properties with many warrens as they are able to move faster and rip wider.



Direction to rip warrens (illustration courtesy Will Dobbie)



Extent to rip warrens (illustration courtesy Will Dobbie)

Obviously, ripping is not suitable for warrens located underneath buildings or on steep rocky country. In such cases, other methods (poison baiting, releasing virus or fumigating burrows) should instead be used to reduce rabbit numbers. Warrens should then be either filled in or covered to stop rabbits from re-establishing. Burrows can be blocked with small boulders or rocks (see photo below).

Rock blocking rabbit hole

Harbour destruction

Where there is abundant surface harbour, a high proportion of rabbits may live above ground rather than in underground warrens. Rabbits can make their homes in windrows, dense thickets of shrubs (such as blackberries and lantana) and even in old machinery.

To eliminate these above-ground breeding areas, it may be necessary to:

- burn windrows and log piles
- remove noxious weeds through chemical and physical control
- remove movable objects (such as old machinery) from paddocks.

Sometimes removing harbour can expose warrens underneath. If this happens, the warrens need to be ripped.

Poison baiting

Baiting is not effective as a sole control method and will not eradicate an entire rabbit population. Numbers will quickly increase again, and you will have to continue baiting year after year with no permanent overall change in the rabbit population.

Rabbits can also become 'bait shy' and this method becomes less and less effective over time. Ideally, baiting is best used either before ripping/fumigation to reduce a population, or after ripping/fumigation as a 'mop-up'.

Baiting works best when rabbits are not breeding. During breeding season the majority of the population feeds over a larger-than-normal area, and it is the young rabbits that are most likely to take baits. While numbers will be reduced, animals of breeding age are not likely to be affected.

1080—sodium fluouroacetate

Pre-feeding is required when using 1080 because rabbits will not readily take new feed. The poison-free bait should be laid at least three times over a one-week period before the poisoned bait is laid. (1080-impregnated carrot baits are the most common form of bait used.) The practice helps to ensure that, when the poisoned bait is laid, it will be eaten by most of the rabbit population.

1080 can only be supplied through persons authorised under the Health Act. Your local Biosecurity officer or your local government office should be able to assist you.

Pindone

Pindone is an anticoagulant registered for rabbit control. This poison works by preventing blood from clotting. In Queensland, it is not recommended for broadacre use and is mainly used in urban areas and near farm buildings.

Pindone works best when given as a series of small doses/feeds over a period of three days. Although pre-feeding is not essential, it does enhance the bait uptake by shy rabbits as they get used to the feed prior to any poison bait being laid. To be effective, pindone requires multiple feeds so that the poison can build up to fatal levels in the rabbit's body. Feeding over a number of nights provides plenty of opportunity for most of the rabbit population to consume the required lethal dose. Rabbits poisoned with pindone will usually die within 10–20 days.

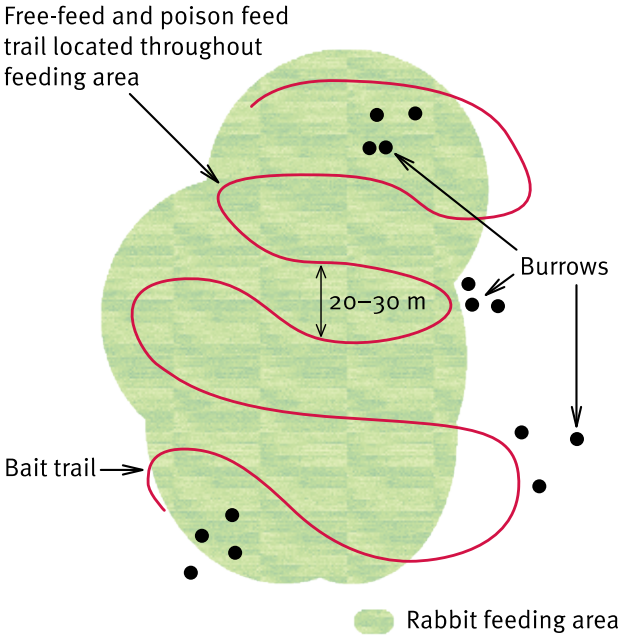
Pindone baiting does not work well when there is a lot of green pick around for rabbits.

Poison bait trails

It is important that bait trails are laid properly to ensure the best results. 'Baitlayers' make it easier to put out bait trails at the correct rate, and they can be towed behind most 4WD vehicles, quad bikes and tractors.

When scratching and laying a trail, consider the following:

- Rabbits like freshly scratched/disturbed soil—this may be because rabbits are territorial and inspect newly disturbed soil, and/or the disturbed vegetation smell attracts them.
- Lay trails around warrens and in the areas where rabbits most often feed.
- Laying trails on slopes and hills requires care—it can cause erosion in some soils types (e.g. granite and traprock). Trails are best laid in a zigzag pattern in steep terrain to minimise erosion.
- A trail that has been scratched for the first feed is easy to follow for the rest of the baiting program.
- The soil should be turned only enough to scratch the surface—don't plough the ground.
- A trail that has been scratched too deep will spook the rabbits because they will not have full sight of their predators.
- Where vegetation is thick, or it is difficult to find the main feeding areas, lay bait trails in a grid pattern across the site.
- As a general rule, avoid crossing the bait trail—it can cause confusion when you try to follow the same trail on subsequent occasions.



Method for laying a bait trail (illustration courtesy Animal Control Technologies)

Bait trials will be most effective if you follow these guidelines:

- Use good quality, non-contaminated bait material. (Simple rule: if you wouldn't eat it, the rabbit won't either.)
- Use enough feed to bait all the rabbits in the area. (The pre-feed will give an indication of the potential bait take.)

- Expect a greater uptake of pre-feed and bait material when vegetation is scarce, dried off or soured.
- Ensure that all the preparation equipment is clean and free of any chemical residues or smells—rabbits can be very shy of unusual odours.
- When there are kittens in a warren, lay the bait trail close to the warrens.

Fumigation

Fumigation is labour intensive and time consuming, and is not usually an effective method if used alone. However, as a 'mop-up' technique or control method for use in areas where ripping is not practical (e.g. steep and rocky terrain), it may be a good alternative.

Because this technique relies on directly affecting the rabbits, and does not affect the structure of the warren, it is crucial that as many rabbits as possible are underground when fumigation is carried out. Rabbits usually take refuge in their burrows from mid-morning to mid-afternoon and during hot weather so these are the best times to fumigate. Dogs can also be used to drive rabbits into their warrens.

For best results, fumigation should be carried out in two stages—initially, before the breeding season starts (as this reduces the breeding stock), and then again during the breeding season.

There are two types of warren fumigation—static and pressure. In Queensland, static fumigants are a more popular and safer option for controlling rabbits and will be explained below.

Static fumigation

This method is easy to use, and time- and cost-effective. Static fumigation comes in the form of aluminium phosphide (phosphine) tablets, which can be purchased from most agricultural suppliers. These tablets are small and round (about the size of a marble), and weigh 3 g. Trade names for phosphine include Pestex®, Quickphos® and Gastion®. General directions for the use of phosphine tablets appear below, but always refer to the manufacturer's specific recommendations for use.

To fumigate warrens using phosphine tablets:

1. Find all warren entrances—both active and inactive.
2. Cut back the warren entrance at right angles using a shovel.
3. Separately wrap two tablets in moistened absorbent paper (toilet paper/paper towels).
4. Insert the tablets as far down into the entrance as possible. (Polypipe and a push rod can be used to help push the tablets down.)
5. Push some scrunched-up newspaper down the hole to block the entrance and then cover it up with soil and, if possible, a rock.
6. Treat all entrances to the warren (active and inactive) the same way.
7. Check warrens about a week after fumigation and re-fumigate any reopened entrances.

Once in the warren, the moistened tablets react with air to release a toxic gas, which spreads quickly throughout the warren. The phosphine gas itself is invisible and odourless but leakages from the warren can be detected by the smell of ammonia. (This is a safety mechanism that is built into the tablet.) Any leakages need to be blocked immediately.

Biological controls

Rabbit hemorrhagic disease virus (also known as rabbit calicivirus disease)

RHDV is a virus specific to rabbits which works by infecting the lining of the throat, lungs, gut and liver.

RHDV relies primarily on direct rabbit-to-rabbit contact in order to spread. High rabbit numbers are therefore needed before this control method will be effective.

After RHDV has infected an area, it is important to use another method for follow-up control to increase the likelihood that the population is eradicated before it is able to develop resistance and increase its numbers again.

Resistance to RHDV depends primarily on the age of the rabbit. Therefore, it is better for RHDV to go through a rabbit population after rabbits have bred and the young are old enough to be affected by the virus. Rabbits that survive RHDV develop antibodies against the virus. Breeding females can also pass these antibodies on to the young (through antibodies in their milk), conferring temporary protection on rabbits up to 12 weeks old.

Myxomatosis

Myxomatosis is no longer produced as a laboratory strain but field strains are still known to recur and affect rabbit populations.

Trapping

Trapping is an extremely labour-intensive control method and requires a skilled operator to set the traps to successfully capture rabbits.

If you do plan to trap rabbits on your property, common sense and respect for animal welfare are essential. While there are currently no strict guidelines for the use of traps in Queensland, it is an area of growing concern for animal welfare advocates.

Cage trap

A cage trap has a lever that closes the cage when a rabbit steps on it. The rabbits are lured into the cage with bait—usually diced carrot. Traps need to be disabled and left open for two or three nights with bait leading into the cage. This entices rabbits to enter. A trap can be set once a rabbit has consumed a trail of bait all the way into that

trap. Traps should be checked and emptied regularly—usually a couple of times a night.

This effective and humane technique is most useful for removing any remaining rabbits from places like hay sheds and after the shed has been fenced to prevent additional rabbits from entering and leaving. Free-feed then trap, and keep the shed rabbit-proof to prevent rabbits recolonising.

Barrel trap

A barrel trap is designed specifically for rabbits. It is cylindrical, made of light mesh, and is about 1 m long and 15 cm in diameter. The trap has one open end with two hinged trap doors along its side. The open end is placed in the burrow, and the hinged gates close and trap the rabbit after it enters from the burrow.

The trap can be left in the burrow entrance for a number of days. However, it must be checked at least daily so that if a rabbit has been caught it does not suffer and animal welfare responsibilities are met.

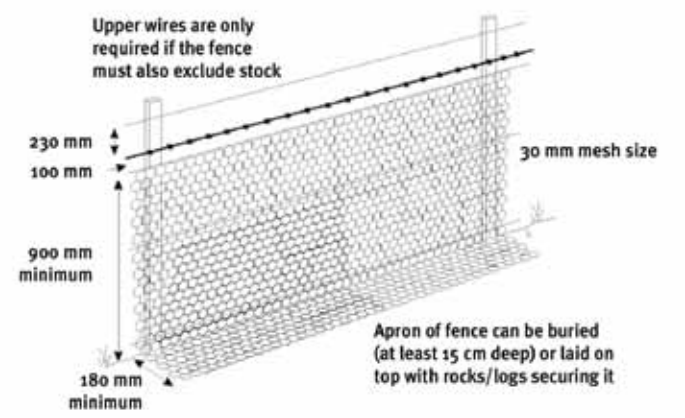
Barrel rabbit trap in hole

Exclusion fencing

Rabbit exclusion fences are built with the aim of keeping rabbits out of a particular area. It is appropriate for small, high-value areas that require protection. A fully fenced area will only remain rabbit-free in the long term if all rabbits are removed from the enclosed area after fencing and the fence is regularly maintained and checked for holes.

A rabbit-proof fence should be made of wire mesh netting (40 mm or smaller) and needs to be at least 900 mm high. The netting should also be buried to depth of at least 150 mm. Gates into the fenced area need to be rabbit-proof as well.

Electric fencing is a cheaper alternative, but it is not a complete physical barrier and is also prone to damage from other pest animals and stock.



Exclusion fence for rabbits (illustration courtesy DEWHA)

Shooting

Shooting is most useful when used to 'mop up' after other control methods (such as ripping). To get the best results, shoot at the time of day when rabbits are active. This is usually in the early morning, late afternoon or at night. The best and most economical firearm to use is a .22 calibre rifle.

If your property is within an urban area, you will need to comply with local government regulations and the *Police Powers and Responsibilities Act 2000*, which restrict the use of firearms.

Further information

For further detailed reading information on specific rabbit control techniques or costing your rabbit control please refer to Rabbit control in Queensland; a guide for land managers. Download from the Biosecurity Queensland website at www.biosecurity.qld.gov.au

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

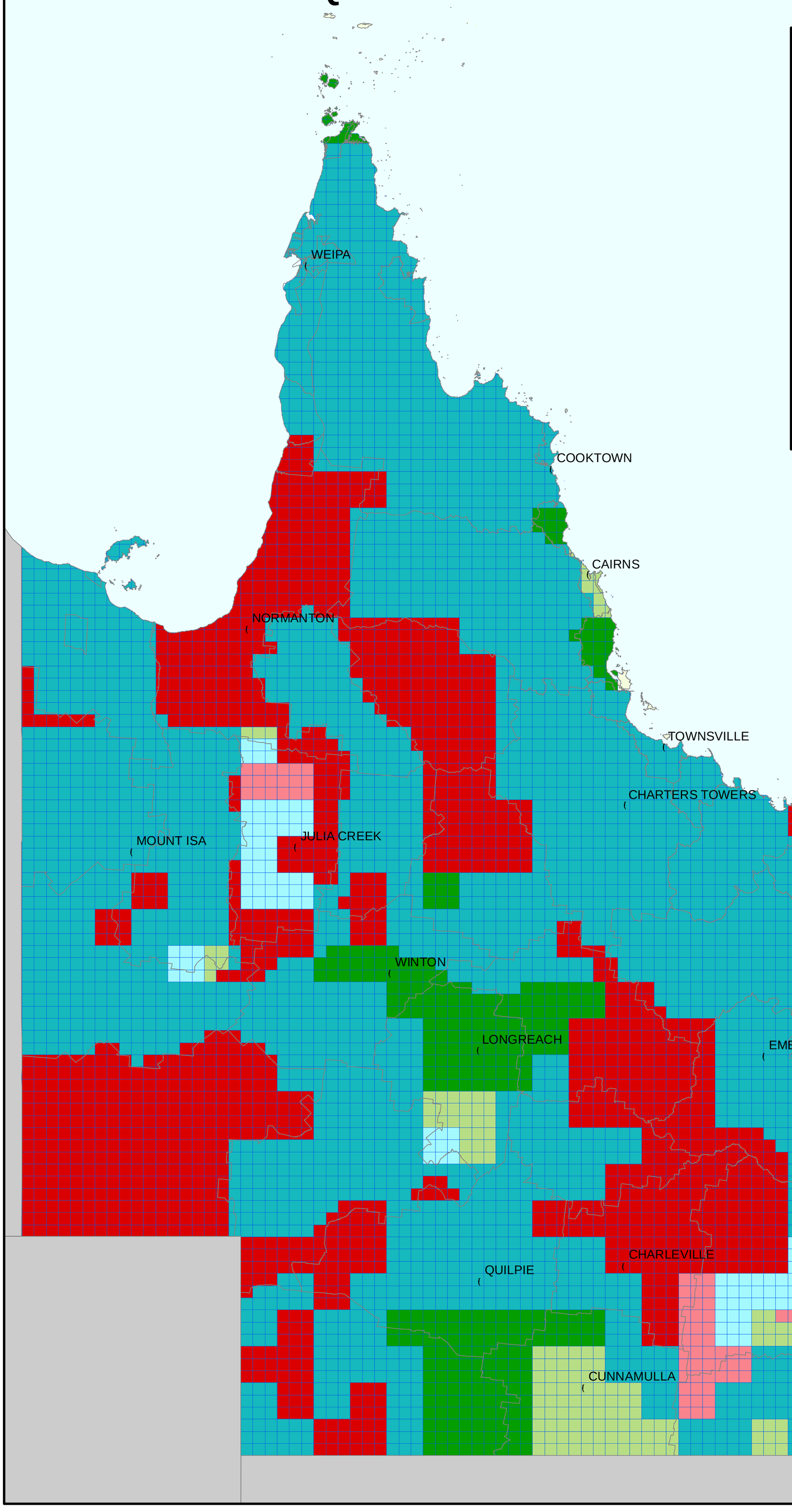
PR10–5192

A.8 Wild Dog / Dingo

WILD DOG

(Canis familiaris)

QUEENSLAND DISTRIBUTION 2007



LEGEND

Density	*Distribution* Widespread	Localised
Abundant		
Common		
Occasional		
Absent		
Unknown		
LGA boundary		

Digital data supplied by: Department of Primary Industries & Fisheries (DPI&F)

Map produced: Pest Information Management, Biosecurity Queensland, DPI&F

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PESTINFO

Queensland Government
Department of Primary Industries and Fisheries

Fact sheet

DECLARED CLASS 2 PEST ANIMAL

Dingoes

Canis familiaris dingo

The dingo *(Canis familiaris dingo)* is a primitive canid related to wolves and coyote. The dingo was not a part of the ancestral fauna of Australia. Though its origins are not clear, it is thought to have arrived in Australia 3500–4000 years ago.

It is the largest mammalian carnivore remaining in mainland Australia, and as such fills an important ecological niche. Females weigh about 12 kg and males 15 kg.

The dingo has been regarded as a serious predator of domestic stock since early European settlement in Australia. Early research emphasis was on control, indeed eradication of the dingo. No attempt was made to study the animal, measure predation, or to understand why the problem existed.

Declaration details

Under the *Land Protection (Pest and Stock Route Management) Act 2002* the dingo/wild dog is a declared Class 2 pest animal. It is the responsibility of landholders to reduce the number of dingoes/wild dogs on their property.

Queensland Government

PA9 July 2010

Description and general information

Red, ginger and sandy-yellow are the dominant coat colours, though dingoes can also be pure white, black and tan or solid black.

It is not difficult to distinguish between most dingoes and hybrids. The presence of domestic genes is suggested by broken colours—brindling and patchiness in the normally pure white feet and chest patch and sable colouration (black hairs along the back and sides).

Dingoes have a more heavily boned skull and larger teeth (especially the canine) than domestic dogs of similar size.

Distribution

Dingo numbers are believed to be higher today than in pre-European times. This is thought to be due to increased food availability via the introduced rabbit and cattle carcasses, and the development of permanent waters in arid areas of the state.

Dingoes/wild dogs are now present in all parts of the state.

The distribution of the wild dog in relation to purebred dingoes varies throughout the state. In far western areas, most dingoes sighted appear to be 'pure', with characteristic white points and broad heads. Closer to settled areas a greater number of feral domestic dogs produce a generally hybrid population. It has been estimated that dingoes are 50% pure in south-eastern Queensland and 90–95% pure in south-western and central Queensland.

Reproduction

Dingoes have only one breeding season per year (usually April to June), whereas domestic bitches have two or more oestrus cycles per year. However, unless seasons are particularly favourable, or human sources of food are intentionally or inadvertently provided, feral domestic dogs are unlikely to successfully rear two litters per year.

After a nine-week gestation, dingo pups (usually four to six) are born in a hollow log or cave den. Bitches tend to use the same den each year. Pups are suckled at four to six weeks and generally weaned at four months. When large enough to travel, pups are taken from the den to kills, and other dens many be used. The range of pups is increased as they are moved from den to den. In this way the pups are gradually moved around the bitch's home range.

Independence may occur as early as six months of age when parents abandon them, but this results in high juvenile mortality. Pups that become independent around 12 months appear to disperse voluntarily. Being larger and more experienced, mortality is then usually low.

Where dingoes live alone or in small groups (most pastoral and semi-settled areas), mature females will breed successfully each year.

By contrast, dominant female infanticide results in only one litter being successfully raised each year within groups containing several adult females (e.g. undisturbed areas such as the Simpson Desert). The dominant (alpha) female will kill all pups of the other females, and then use subordinate females to suckle and rear her litter.

Home range

Radio tracking studies show dingoes occupy a discrete area known as a 'home range'. The dingo visits the edge of this area frequently.

The home range can vary in size according to the productivity of the country—from 9 km² in rainforest areas to 300 km² on the Nullarbor Plain.

The edge of the home range is commonly associated with a major topographic feature (e.g. an escarpment, a major ridge or stream).

The home range is not used uniformly. Activity is centred on areas with highest food density.

Hunting movement is slow and exploratory, in contrast to frequent rapid movement around the home range boundary.

Pads follow well defined paths and are most likely associated with sociality and home range boundary maintenance. Activity is highest at dusk and dawn.

Social organisation

Dingoes in an undisturbed area generally belong to discrete packs (3–12 members), which occupy long-term, non-overlapping territories. The group rarely moves as a pack—rather, members meet and separate again throughout the day. Dingoes are most gregarious during the breeding season.

There is overlap of home ranges within a group. In contrast, boundaries between groups are more rigid, actively defended and infrequently crossed.

Olfactory communication (smell) is important in dingo social organisation. Dingo droppings are deposited along pads in specific areas where other dingoes will encounter them (creek crossings, intersections of roads and fences).

These 'scent posts' appear to delineate the home range boundary and act as a warning to neighbouring groups and individuals.

This strong site attachment of dingoes is contrary to the notion commonly held by property owners that dingoes will travel large distances to kill stock.

Diet

Dietary research of stomach content and faecal scats has shown dingoes are opportunistic predators.

Medium-size animals such as kangaroos, wallabies, rabbits and possums consistently form the major part of the dingo diet.

Studies by the Western Australia Agriculture Protection Board show dingoes in undisturbed refuge areas killed and ate kangaroos strictly according to need.

On grazing country, however, 'dingoes harassed, bit or killed sheep in large numbers, often without eating any'. The consumption of these sheep carcasses was the exception rather than the rule. Even kangaroos in these areas were sometimes killed in 'play' type behaviour rather than for food.

Such dietary studies could suggest dingo predation of domestic stock is low. There is, however, a need for caution in using such studies to assess dingo impact on stock.

Grouping increases foraging efficiency and appears necessary to exploit larger prey. Dingoes cooperating in groups are more successful in hunting kangaroos than lone dingoes are. While lone dingoes can easily kill sheep, it is less likely a solitary dingo would successfully attack a calf in the presence of a defending cow.

Disease threat

Dingoes are vectors of canid diseases (e.g. distemper, parvovirus) and parasites. The hydatid parasite *Echinococcus granulosus* is a major problem of dogs and domestic stock. It can cause illness and occasionally death in humans.

The dingo could pose a serious risk if the exotic disease rabies was introduced to Australia.

Beneficial considerations

The establishment of watering points during post-European settlement has resulted in a huge increase in the kangaroo population, with consequent strong pasture competition with domestic livestock.

Though it is widely accepted that sheep production is near impossible in the presence of dingoes, many cattle producers will tolerate dingoes because of their believed suppression of kangaroo numbers.

Research has shown that not only does the dingo have the potential to mitigate population growth of native species during abundant seasons, it could also be an important limiting factor for many feral animal populations (e.g. feral pigs and goats).

Destruction of the dingo could cause increases in other pests to the grazing industry and result in widespread degradation of environmentally sensitive areas. However, this has not been proven.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

PR10–5203

Wild dogs

Canis familiaris



The term wild dog refers collectively to purebred dingoes, dingo hybrids and domestic dogs that have escaped or been deliberately released.

Early management strategies focused on eradication of wild dogs. The effectiveness of control campaigns was usually based on circumstantial evidence.

The development of radio-tracking technology provided the opportunity to study wild dog movement and allowed better assessment of the effectiveness of control operations.

Wild dog control methods include trapping, shooting, fencing, poisoning and the use of guard dogs to protect valuable stock. A planned strategy using a combination of these methods that also considers wild dog behaviour will enable effective management of the population.

Declaration details

Wild dogs are declared animals under the *Land Protection (Pest and Stock Route Management) Act 2002*. As such, all land owners in Queensland are required to reduce the number of wild dogs on their properties.

Control

Shooting

Shooting is an opportunistic method, mostly used for control of small populations or individual problem animals.

Trapping

Trapping is time-consuming and labour-intensive. The success of trapping (using leg hold traps and snares) depends on the skill of the operator. Trapping is predominantly used in areas with low populations and to control 'problem' wild dogs.

Trapping by inexperienced operators may prove detrimental if a wild dog is exposed to a carelessly prepared and presented trap, and subsequently escapes. Such animals may become 'trap shy', or maimed to such a degree that they can prey only on more easily caught domestic stock.

For humane reasons and to prevent escape, poisoning traps with strychnine is recommended to quickly kill captured animals.

A mixture of dog faeces and urine is a popular lure used by trappers. Attractiveness of lures varies with seasons and locations. No single lure has yet been found that is consistently attractive to wild dogs.

Traps are best placed on the wild dog boundary pad. Here the wild dog is most likely to find and investigate the decoy/odour.

Wild dog scent posts can be found by walking with a domestic dog on a lead along a known pad. Trap placement in relation to the scent post can be optimised by observing the dog's behaviour as it approaches. Factors to consider are:

- where on the bush it smells
- placement of feet while urinating/defecating
- how it approaches and where it scratches in relation to the pad and scent post.

Traps are not target-specific and should therefore be set in situations that are less likely to catch other animals. Avoid setting traps close to waterholes.

Padded jaw traps are recommended—these are more humane than steel leg-hold traps.

PA10 July 2010

Queensland Government

Fencing

Fencing suitable to exclude wild dogs is expensive to build and requires continual maintenance to repair damage caused by fallen timber, floods and animals. However, a properly maintained fence can restrict movement back into an area where wild dogs have been controlled.

Electric fences suitable for wild dogs have been developed. Electrifying a fence creates a fear of the fence itself and deters wild dogs from approaching.

For fencing to be successful, it must be possible to eliminate wild dogs from within the fence. The fence must be maintained in good order and occasional mopping-up measures employed to remove intruding animals.

Livestock guardian dogs

Livestock guardian dogs have been used to protect livestock from predators in Europe, Asia and America. Some producers in Queensland's south-east have decreased predation on sheep and goats using this method. However, it is less successful on larger holdings where stock are more widely scattered. The use of trapping and poisoning in conjunction with guardian dogs is not recommended.

Poisoning

Baits poisoned with 1080 are the most economic, efficient, humane and effective method of controlling wild dogs, especially in inaccessible or extensive areas. Baits can be laid quickly in large numbers by hand, from vehicles and from aircraft.

Currently there are two poisons legally available for wild dog control. These are 1080 (sodium monofluoroacetate) and strychnine.

A Queensland Health permit is necessary to purchase strychnine. The 1080 poison can be obtained only through licensed Biosecurity Queensland officers and local government operators.

The use of poison baits will control the majority of wild dogs. Problem animals that avoid baits can then be trapped, shot or fenced-out to provide additional control.

Baits may be selectively positioned to avoid killing non-target species, as wild dogs' keen sense of smell enables them to find baits intentionally buried in sand or otherwise hidden. Baits may also be tied to prevent their loss to non-target species.

These bait placement techniques help to:

- reduce the risk of poisoning non-target species
- minimise bait removal by non-target scavengers
- keep the bait moist (longer palatability)
- deter ants (ant-covered baits are believed to be less attractive to dingoes).

Allow a full month for the major effects of baiting to be realised. Heavy rain within two weeks of baiting can leach 1080 from the bait.

Management strategies

It is generally accepted that wild dogs are in fewer numbers statewide due to the use of 1080 over the past three decades.

To increase baiting effectiveness and the duration of low wild dog numbers, it is essential that baiting programs be coordinated among adjoining properties. Baiting individual properties may result in reduced wild dog numbers in the short term, but the benefits of this will be short-lived due to rapid re-invasion.

Research has shown that recolonising wild dog populations are more prone to attack livestock than uncontrolled wild dog populations. Thus, livestock producers should aim to create a wild dog–free buffer of 10–15 km around grazing areas by regular baiting.

The principal source of re-colonising populations comes from immigration, not increased birth rate of remaining wild dogs.

The timing of control should consider seasonal variations in the availability of water (where water is restricted) and then target watering points. The phase of the biological cycle could also influence the likelihood of wild dogs coming into contact with baits and should be considered. Many graziers bait twice a year to target adults during peaks in activity associated with breeding (April/May) and then again in August/September to target pups and juveniles.

A suggested practice is to lay baits in the cooler months when birds and goannas are less active and wild dogs more active.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

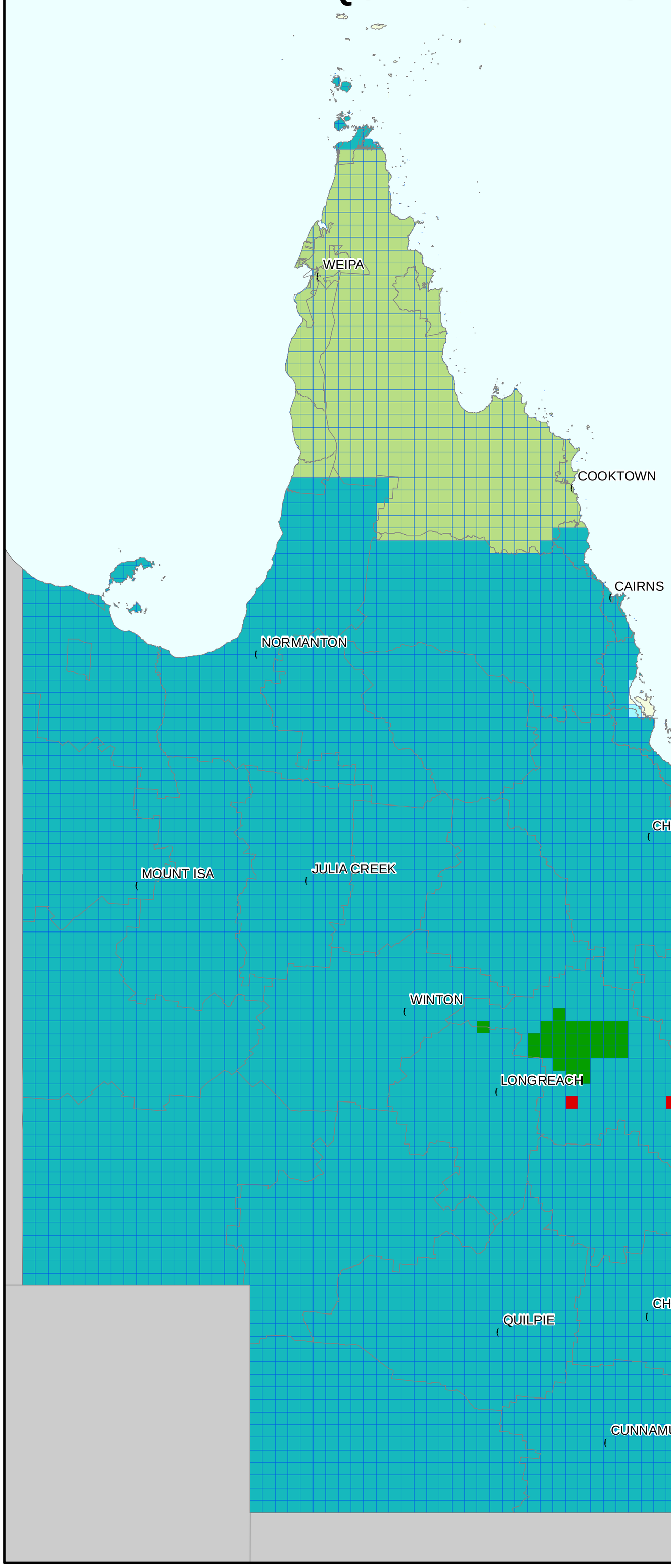
PR10–5204

A.9 Feral Cat

FERAL CAT

(Felis catus)

QUEENSLAND DISTRIBUTION 2007



LEGEND

Density	*Distribution* Widespread	Localised
Abundant		
Common		
Occasional		
Absent		
Unknown		
LGA boundary		

Digital data supplied by: Department of Primary Industries & Fisheries (DPI&F)

Map produced: Pest Information Management, Biosecurity Queensland, DPI&F

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PESTINFO

Queensland Government
Department of Primary Industries and Fisheries

Fact sheet

DECLARED CLASS 2 PEST ANIMAL

Feral cat ecology and control

A descendant of the African wild cat (*Felis silvestris lybica*), the common 'house' cat (*Felis catus*) has now been domesticated for about 4000 years. Although the domestic cat has a long history of association with humans, it retains a strong hunting instinct and can easily revert to a wild (feral) state when abandoned or having strayed from a domestic situation.

Semi-feral cats live around dump sites, alleys or abandoned buildings, relying on humans by scavenging rubbish scraps and sheltering in abandoned structures. The true feral cat does not rely on humans at all, obtaining its food and shelter from the natural environment.

Declaration details

The feral cat is declared as a Class 2 species under the *Land Protection (Pest and Stock Route Management) Act 2002*. Declared species represent a threat to primary industries and natural resources, and have a social impact on other human activities.

Legislation describes a feral cat as one that is not fed and kept by someone. The word 'kept' specifically means that the cat is housed in a domestic situation.

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PA26 July 2010

Description and general information

The feral cat differs little in appearance from its domestic counterpart; however, when in good condition, the feral cat displays increased overall muscle development, especially noticeable around the head, neck and shoulders, which gives the animal a more robust appearance. The average body weight of male feral cats is 3–6 kg, while females weigh 2–4 kg. Body weights vary with condition, with some extremely large specimens documented.

Australian feral cats are predominantly short-haired, with coat colours that range between ginger, tabby, tortoiseshell, grey and black. White markings may be present on the feet, belly, chest and throat; completely white feral cats are extremely rare. In established populations, coat colours are the result of a natural, genetically selective process. Terrain, predators and the ability to capture prey limit coat colours to those that provide the most suitable camouflage and cause a predominance of these colours in subsequent offspring. Ginger cats are more likely to be found in the semi-arid and desert areas, while grey and black specimens generally predominate in scrub and more heavily timbered habitats.

The feral cat is most active at night, with peak hunting activity occurring soon after sunset and in the early hours before sunrise. At night the cat displays a distinctive green eyeshine under spotlight, making it easily distinguishable from other animals. During the day it will rest in any number of den sites, which may include hollow logs, dense clumps of grass, piles of debris, rabbit burrows, and even the hollow limbs of standing trees.

The most obvious and characteristic field signs of feral cats are their scats (droppings). Unlike the domestic cat, the feral cat does not bury its scats, but leaves them exposed at prominent sites to warn other cats of its territorial boundary.

History of introduction and dispersal

There is some evidence to suggest that the cat was present in Australia long before European settlement. This may have occurred as a result of Dutch shipwrecks and regular visits to northern Australia by early South-East Asian vessels as long as 500 years ago.

Post-settlement dispersal resulted from cats straying from areas of early colonisation. In the late 19th and early 20th centuries, large numbers of cats were purposely released in many rural areas to combat plague numbers of rabbits. Unwanted cats continue to be released into urban and rural areas by irresponsible pet owners.

The feral cat is now present Australia-wide, thriving under all climatic extremes and in vastly different types of terrain.

Population dynamics

Male cats attain sexual maturity at about 12 months, whereas females are capable of reproduction at approximately seven months. Annually, and under ideal conditions, an adult female can produce up to three litters—each of usually four kittens, but varying from two to seven.

As the breeding instinct is triggered by the increasing length of daylight, litters are less frequent in winter. Most reproduction occurs during the spring and summer months, and is generally limited to two litters per year. Birth follows a gestation period of 65 days, and kittens may be reared in a single den site or may be frequently shifted to other sites within the female's home range. Family and litter bonding begin to break down when the kittens are approximately seven months old. The female's ability to bear litters does not decrease with age, so reproduction continues for the course of her life.

Social organisation and behaviour

Feral cats maintain stable home ranges, the sizes of which depend upon the relative abundance of food and the availability of suitable den sites. Dominant male cats may have territories of up to 8 km^2, while the territories of females are smaller and may even be halved while kittens are being reared.

Scent glands are present on the chin, at the corners of the mouth, and in the anal region. Territorial boundaries are maintained by scent marking with the cheek glands, pole-clawing, urinating and leaving exposed faecal deposits.

Although feral cats are often thought of as being solitary animals, studies show this behaviour is generally limited to hunting activities. At other times feral cats display a degree of social interaction that peaks during the breeding season. Group behaviour has been observed in semi-feral populations, and it has been suggested that such behaviour is exhibited also in feral populations.

Groups usually comprise several related adult females, their young of both sexes, and an adult male—whose range may include other groups of females. Young females usually remain in a group, while young males either leave or are driven from the group as they reach sexual maturity.

Effects on wildlife

The energy expended by an adult male cat requires it to consume 5–8% of its body weight in prey per day, while females raising kittens require 20%. Based on these figures, one study concluded that 375 feral cats on Macquarie Island would consume 56 000 rabbits and 58 000 sea birds per year. Where present on the mainland, rabbits may comprise up to 40% of a feral cat's diet. Cats are successful as a control mechanism only when rabbit densities are low. At other times cat predation does little to halt the build-up or spread of rabbit populations; rabbits merely help to support a larger number of cats. When seasonal shortages of rabbits occur there is a corresponding rise in the number of native animals taken by cats.

The feral cat is an opportunistic predator, and dietary studies have shown that small mammals, birds, reptiles, amphibians, insects and even fish can be taken as prey. Cat predation is particularly harmful in island situations, and a number of species have become extinct due to the introduction of cats by early sealers and lighthouse keepers. On the mainland, native animals—which already suffer due to the destruction of their habitats by man and other introduced animals—may be endangered further by cat predation. Actual competition for prey can cause a decline in the numbers of native predatory species such as quolls, eagles, hawks and reptiles.

Not only do native animals bear the brunt of predation, but they also suffer the effects of a parasite that reproduces only in the intestine of the cat. This disease (toxoplasmosis) is particularly harmful to marsupials, which may develop blindness, respiratory disorders, paralysis, and suffer the loss of offspring through abortion and stillbirths.

Exotic disease—rabies

Due to their widespread distribution, feral cats may prove to be a major vector for this fatal viral disease if it ever enters Australia. Overseas studies have revealed that wounds inflicted by rabid cats are more dangerous than those caused by rabid dogs. While the bites of rabid dog are generally inflicted on the arms and legs, the cat attacks the head of its victim, biting and clawing viciously. These head and facial bites reduce the time taken for the virus to enter the central nervous system, lessening the chance of success from subsequent remedial treatment.

Control

Exclusion

Fencing is the only feasible method of control when special areas need protection from cats. Feral cats have been successfully prevented from climbing over netted fences that use an electrified wire mounted 15 cm from the top and 10 cm outward from the fence. Non-electrified fencing should incorporate a netted ceiling, or a curved overhang, which prevents the cat from climbing straight up and over the fence.

Shooting

Night shooting is assisted by the cat's distinctive, green eyeshine. Cats have been successfully attracted by the use of a fox whistle.

Poisoning

Registration of the vertebrate pesticide sodium fluoroacetate (1080) is currently being sought for the control of feral cats where conditions for its use are suitable.

Audible recorded lures for feral cats and other predators are available through a number of sources. These recordings mimic the distress call of a small animal and can be use to draw a predator to a bait or trap site.

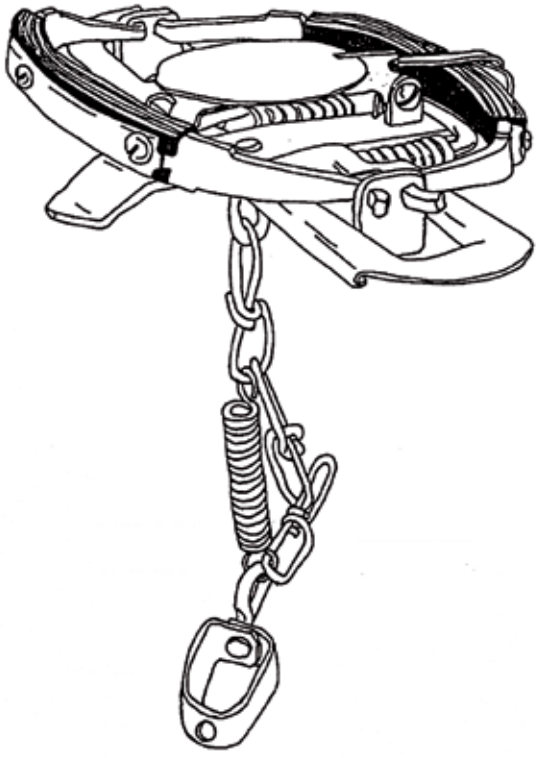
Trapping

Rubber-jawed, leg-hold traps (see below) can be laid in the same manner as they are laid for dingoes and foxes. Leg-hold traps can work well with true feral cats, which would normally avoid the live-capture box traps.

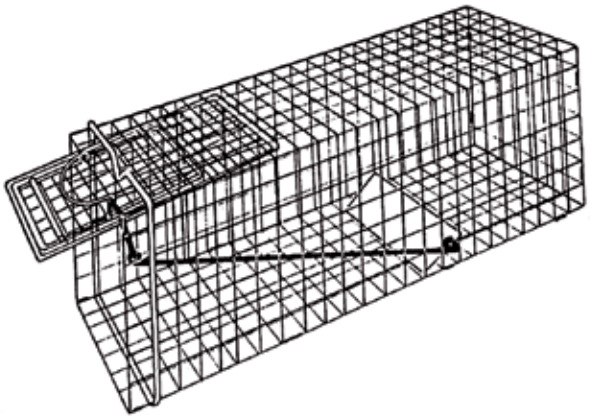
Ideal sites are those where territorial markers, such as faecal deposits and pole-clawing, are noticed. Tuna fish oil has shown some success as an attractant; however, feral cats seem more readily attracted to a site by some visual stimulus such as a bunch of bird feathers hung from a bush or stick.

Cats are easily trapped in wire 'treadle-type' box traps (see diagram at right). This method is most practical for semi-feral urban cats. Attractants/lures may be of meat or fish and should be placed so that they cannot be reached through the wire and be retrieved by clawing.

A number of local governments lend cat traps for the purpose of removing stray and feral cats in urban situations.



Rubber-jawed leg-hold trap



Treadle box trap

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

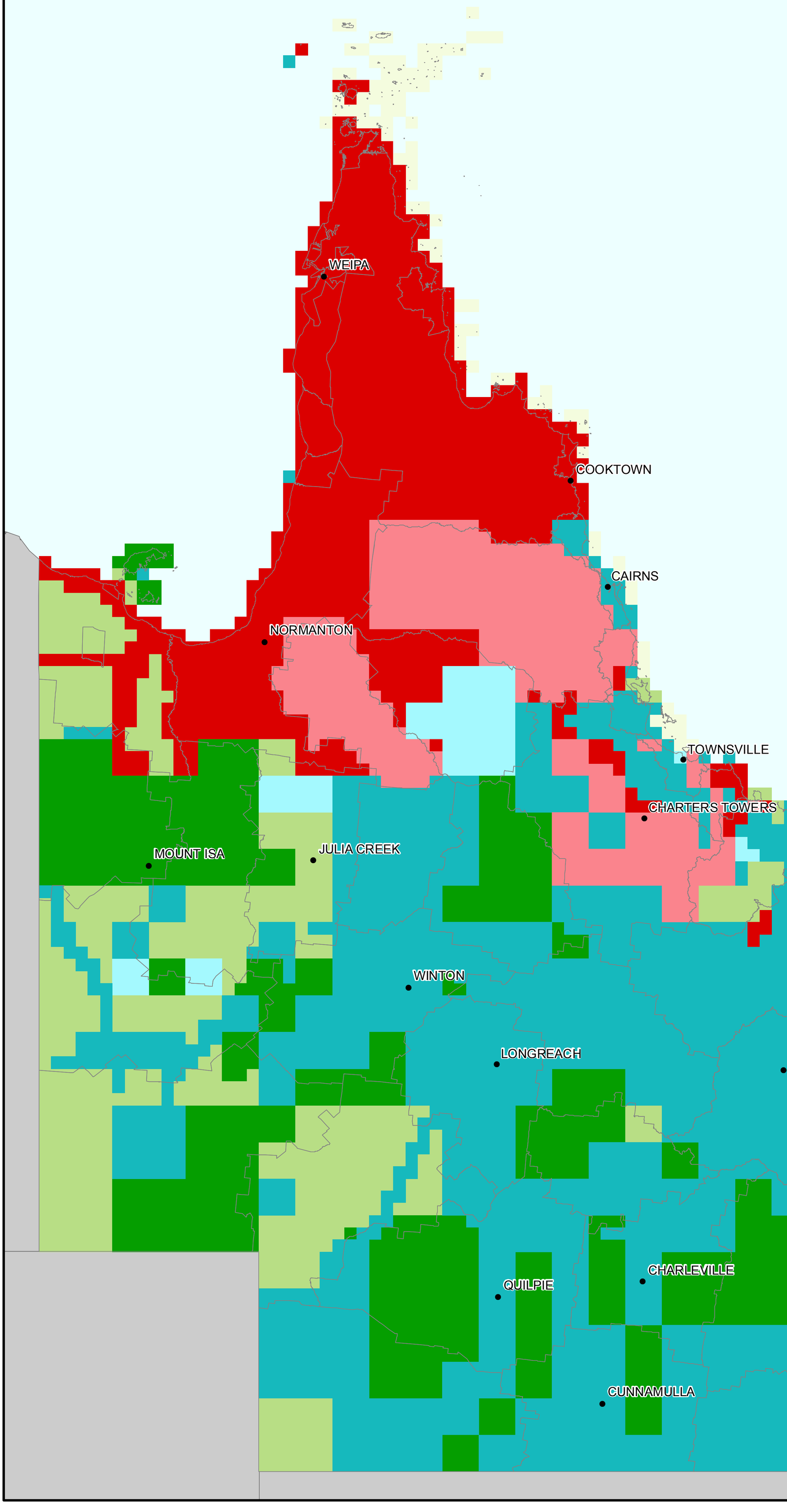
PR10–5193

A.10 Feral Pig

FERAL PIG

(Sus scrofa)

QUEENSLAND DISTRIBUTION 2008



Queensland Government
Department of Primary Industries and Fisheries

APDS 2008

Density	*Distribution* Widespread	Localised
Abundant		
Common		
Occasional		
Absent		
Unknown		
LGA boundary		

N

Digital data supplied by: Department of Primary Industries & Fisheries (DPI&F)

Map produced: Pest Information Management, Biosecurity Queensland, DPI&F

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PESTINFO

Fact sheet

DECLARED CLASS 2 PEST ANIMAL

Feral pigs in Queensland

Distribution, ecology and impact

Domestic pigs (*Sus scrofa*) were introduced to Australia by early settlers. Subsequent accidental and deliberate releases resulted in the wild (feral) population establishing throughout Australia.

Feral pigs damage crops, stock and property, spread weeds and transmit diseases such as leptospirosis and foot-and-mouth. They also cause environmental damage, digging up large areas of native vegetation and spreading weeds.

Declaration details

Feral pigs are declared Class 2 pests under the *Land Protection (Pest and Stock Route Management) Act 2002*. Declaration requires landholders to control declared pests on land under their control. A local government may serve a notice upon a landholder requiring control of declared pests.

For information on feral pig control, see Biosecurity Queensland's fact sheet *Control of feral pigs* (www.biosecurity.qld.gov.au).

Description and general information

Australian feral pigs have more in common with their Eurasian cousins than with domestic pigs. They are smaller, leaner and more muscular than domestic pigs, with well-developed shoulders and necks and smaller, shorter hindquarters. Their hair is sparse and longer and coarser than domestic pigs. Feral pigs also have longer, larger snouts and tusks, straight tails, smaller mostly pricked ears and much narrower backs.

Colouring is predominantly black, buff-coloured or spotted black and white. Some are agouti-patterned (dark hair with a lighter tip). Juveniles may be striped. Colours vary between and within areas.

Growth potential is similar to domestic pigs, although harsh environmental conditions tend to stunt development. Adult female feral pigs usually weigh 50–60 kg, while males usually weigh 80–100 kg. Exceptional animals have reached 260 kg.

Older boars (razorbacks) have massive heads and shoulders and a raised and prominent back bone that slopes steeply down to small hams and short hind legs. A keratinous plaque or shield up to three centimetres thick usually develops on their shoulders and flanks.

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PA6 July 2010

This provides some protection from serious injury during fights with other boars. Some boars develop a crest or mane of stiff bristles extending from their neck down the middle of their back, which stands straight on end when the animal is enraged.

Habitat and distribution

Feral pigs inhabit about 40% of Australia from subalpine grasslands to monsoonal floodplains and are found in all habitat types in Queensland (see Figure 1).

Estimations of feral pig numbers in Australia range up to 24 million. The greatest concentrations of feral pigs are on the larger drainage basins and swamp areas of the coast and inland.

Biology and behaviour

Feral pigs are capable of migrating considerable distances, but tend to stay within home ranges. Watering points are the focus of activity, particularly during hot weather. Pigs have few sweat glands, so high temperatures require them to drink more often and wallow in water or mud to cool off. Dense cover is the preferred habitat, providing protection from the sun and their main predator—humans.

Female and juvenile pigs usually live in small family groups with a home range of 2–20 km^2. Adult males are typically solitary, with a home range of 8–50 km^2. Range size varies with season, habitat, food availability and disturbance. Herds of 400 pigs have been recorded in Cape York.

Most pigs remain in their home ranges, even when subject to some disturbance such as infrequent hunting by people and dogs. Regular disturbance will drive them on.

Feral pigs are generally nocturnal, spending daylight hours sheltering in dense cover. They are shy animals and will avoid humans, making it easy to miss their presence or to drastically underestimate their numbers.

Pigs are omnivorous, eating plants and animals. They are extremely opportunistic feeders, exploiting any temporarily abundant food. They prefer green feed and will eat grains, sugarcane and other crops, fruit and vegetables. They root extensively for tubers, worms and soil invertebrates. Small animals are preyed upon. Stock losses occur primarily with lambs but occasionally with newborn calves. Carrion (dead and rotting flesh) is also consumed.

Feral pigs have relatively high energy and protein requirements, particularly during pregnancy and lactation. These requirements are not available all year in all areas, so pigs often have to move to other parts of their home range during pregnancy.

This seasonal need for either more food, or high-energy or protein-rich food, is often the reason for their impact on agricultural crops. It is also the weakness in their ecology that can be exploited for management purposes.

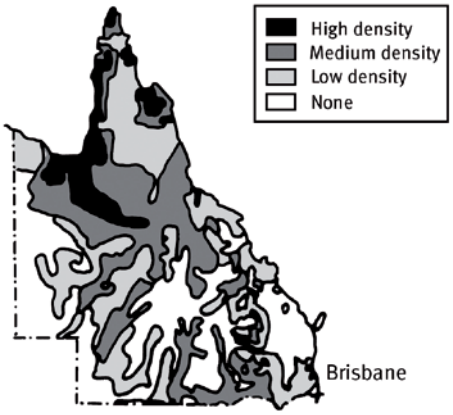

Figure 1. Distribution of feral pigs in Queensland

Life cycle

The reproductive potential of feral pigs is more similar to rabbits than other large mammals in Australia. In good conditions, feral pig populations may increase fivefold in a 12-month period.

Under favourable conditions, breeding occurs all year. Adult females have a 21–day oestrus cycle, with a gestation period of about 113 days, producing a litter of 4–10 piglets, depending on the sow's age, weight and food supply.

Sows can make nests of available vegetation just before farrowing. Nests can be 3 m long by 1.5 m wide and up to 1 m high, with a domed roof. Nests are usually less than 2 km from available water. Piglets normally spend the first 1–5 days of life inside the nest, with the sow inside or close by.

The next fertile mating can occur after 2–3 months of farrowing, allowing sows to produce two litters per year if good seasonal conditions prevail.

Weaning occurs after 2–3 months. Sexual maturity is reached when sows weigh about 25 kg, usually around six months of age.

Mortality of juveniles is high if the mother's dietary protein intake is low (up to 100% mortality in dry seasons). Adult mortality does not vary as much with seasonal conditions, but few animals live more than five years.

Estimating populations

Sightings are the least reliable guide to feral pig presence. Careful observation of the signs of pig activity will allow an experienced observer to estimate population densities. Inexperienced observers, however, may see nothing.

The following is a list of common pig signs that may be used to establish relative numbers and sizes:

- fresh digging or rooting of ground (causing a ploughed appearance). This indicates recent pig activity, but the area affected gives little indication of numbers as large areas can be dug by a small number of pigs
- tracks and faeces on and off pads. Faeces size, shape and consistency vary with age and diet, but is typically 3–6 cm wide, 7–22 cm long and well formed. Close inspection can help determine diet (e.g. plant matter and seeds, egg shell and bone fragments, wool and marsupial hair)
- mud or hair at holes in fences where pigs have pushed through
- wallows. Pigs leave distinctive oval depressions in mud
- tusk marking and mud rubs on trees and fence posts. These give an indication of pig size
- nests in vegetation made by sows before farrowing. Be sure to approach these with caution.

Spotlighting, aerial survey, and use of dogs can be used for actual pig counts.

Human and environmental impacts

Feral pigs wide habitat range, omnivorous diet and potential for rapid population growth in good seasons mean that few agricultural pursuits are unaffected by these pest animals. Damage is estimated at $100 million annually.

Economic impact is of three types:

1. value of the direct losses to agricultural production
2. value of the continuing expenditure on pig control
3. value of lost opportunities (i.e. control expenditure reduces opportunity to profit from alternative investments).

Examples of direct agricultural losses are listed below.

Crops

Pigs can damage almost all crops from sowing to harvest, starting with uprooting seed and seedlings to feeding on or trampling mature crop.

They feed on seed and grain crops (except safflower), fruit (especially banana, mango, papaw, macadamia and lychee) and vegetable crops.

Most damage to sugarcane occurs during the dry season. Older cane with a high sugar content is preferred. Because sufficient moisture can be obtained from the cane, pigs can 'camp' in a paddock for several weeks (causing substantial damage).

Livestock

Predation on livestock is basically limited to lambs. Research has shown feral pigs can take up to 40% of lambs. This not only reduces income from the sale of lambs, but also reduces the opportunity for herd improvement by limiting selection for optimum wool traits.

Pasture

Pastures are damaged by grazing and rooting. Pigs can also transport weeds; their diggings provide ideal conditions for weed establishment.

Fences and watering points

Wallowing pigs damage and foul the water in tanks and bore drains and silt up troughs. Rooting can weaken dam walls. Being large, powerful animals, pigs can breach fences, providing passage for other pest animals.

Environmental concerns

Pig activity has a dramatic effect on creeks and lakes. In many areas concentrated rooting 'ploughs' up to 20 m around the waterline.

Such disturbance of the soil and natural vegetation degrades water quality and the habitat for small terrestrial and aquatic animals. It also creates erosion and allows exotic weeds to establish.

Predation of native fauna does occur and examination of faeces has shown remains of marsupials, reptiles, insects, and ground-nesting birds and their eggs.

Diseases and parasites

Feral pigs can carry many infectious diseases and internal and external parasites. Some are endemic (already present), while others are still exotic to Australia.

Many of the diseases can spread to domestic pigs, other livestock and humans. Diseases naturally transmitted from animal to man are called 'zoonoses'.

Zoonoses currently in Australian feral pigs

- **sparganosis** – a parasite that can infest the muscles of humans, forming encyst lumps. Common in pigs from swampy areas. Contracted by ingesting raw meat
- **melioidosis** – a serious bacterial disease that causes abscesses
- **leptospirosis** – a serious bacterial disease; in humans called Weil's disease, causing very high temperatures, kidney trouble and jaundice; can be fatal. It is found in up to 20% of feral pigs in Queensland
- **Q fever** – occurs in all animals and is well known by meat workers. It can cause very high temperature and result in heart problems; can be fatal
- **tuberculosis** (TB) – a serious disease of the lungs. Once common but now rare, it is contracted by eating inadequately cooked flesh of infected animals

- **brucellosis (porcine and bovine)** – a bacterial disease causing severe long-term illness, undulant fever and possible infertility, both strains are contracted by handling raw meat. Porcine brucellosis is rare in Queensland.

Feral pigs were blamed for the spread of TB and bovine brucellosis among cattle but both diseases have been eradicated from Queensland without directly targeting feral pigs.

Leptospirosis and Q fever infection can occur through contact with blood, meat and urine through broken skin, intake of urine-contaminated food or water, and inhalation of infectious airborne organisms.

Brucellosis, leptospirosis and Q fever cause flu-like symptoms similar to Ross River fever. Leptospirosis and Q fever can be fatal.

To prevent contracting these diseases it is advisable to avoid handling feral pigs. Slaughtering and butchering should be undertaken only at licensed premises where there is a full-time meat inspector on duty to ensure that animals are free of the above diseases.

If you must handle feral pig meat, use suitable protective clothing (mask, goggles, strong rubber gloves and plastic apron and boots) to minimise contamination with blood, urine and faeces.

Rare or undercooked meat should not be eaten; thoroughly cook meat to avoid contracting pathogens.

Exotic livestock diseases

A major concern with feral pigs is their potential to harbour or spread exotic livestock diseases. The cost to the Australian community if foot-and-mouth disease were introduced to Australia is estimated at $3 billion in lost export trade, even if the outbreak were eradicated immediately.

This would result in major social upheaval in rural Australia.

Other exotic diseases of concern:

- **swine vesicular disease** – viral disease affecting only pigs
- **Aujeszky's disease** – highly contagious herpes viral disease affecting several animal species, killing up to 100% of affected piglets
- **African swine fever** – highly contagious viral disease affecting only pigs; mortality rate is high
- **classical swine fever** (CSF) – also called hog cholera. This highly contagious viral disease of pigs kills up to 90% of infected animals in its acute form.

For more information on animal diseases contact your local Biosecurity Queensland veterinarian.

Exotic zoonotic diseases and parasites

- **Japanese encephalitis** – a virus spread from pigs to humans by mosquitoes, causing acute severe problems of the nervous system (pain, sleepiness and coma)
- **rabies** – a serious disease affecting the brain; can be fatal
- **screw-worm fly** – maggots from this fly can attack healthy flesh; if untreated can cause massive wounds to animals and humans
- **trichinosis** – a helminth (roundworm). All mammals are susceptible, with humans infected by eating improperly cooked meat.

North Queensland's popularity as a tourist destination is increasing. Many international visitors have travelled through countries infected with exotic diseases before entering Australia. Feral pigs are known to frequent rubbish tips around tourist lodges and scavenge human waste.

There is a real danger that an exotic disease could enter Australia via this contact and remain undetected for some time. Such a time lapse could allow the disease to become widespread, making eradication difficult or even impossible.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

PR10–5194

Control of feral pigs

In Queensland, feral pigs (*sus scrofa*) are declared Class 2 animals under the *Land Protection (Pest and Stock Route Management) Act 2002* and their control is the responsibility of every landholder.

Feral pigs are difficult to control for a number of reasons.

- They are nocturnal animals, camping through the day in mainly inaccessible vegetation where vehicle access is often impossible.
- Pigs have a relatively short gestation period and produce a large number of offspring, so repeated control programs must be conducted before any sustained population reduction is achieved.
- They are omnivores: a species that eats both plants and animals as their primary food source, which makes successful pre-feeding difficult.
- Their home ranges are large—between 2 and 50 km^2; thus, control programs need to be conducted over a wide area (often including several properties) to be effective.

For more information on feral pig distribution, ecology and impact see the fact sheet *Feral pigs in Queensland*.

How to develop a pig control strategy

The strategic management of feral pigs is aimed at minimising the damage they cause to primary production and conservation areas.

Strategic management involves four key components:

Defining the problem—first, you need to define the true impact of feral pigs on the valued resource. This sets a justifiable cost of control.

Management plan—next, it is important to determine the best combination of control methods for your control program. Often the most effective approach is to coordinate on a local and regional level.

Implementation—actions often involve the cooperation with neighbouring land managers, both private and public.

Monitoring and evaluation—monitoring determines the cost-effectiveness of each control method and the overall efficiency of the strategy. Evaluation establishes if and how management should be changed.

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Trapping

Trapping is an important technique that is most useful in populated areas, on smaller properties (‹5000 ha), and where there are low pig numbers. Trapping can be useful in 'mopping up' survivors from poisoning programs. It is most successful when food resources are limited.

Trigger mechanisms for pig traps can be made pig- specific and therefore pose little danger to other wild or domestic animals.

Advantages

- This is the safest form of control and can be safely undertaken on closely populated areas.
- Flexible and can be incorporated into routine property activities, making economical use of labour and materials.
- Carcases can be safely disposed of.
- Traps can be moved and re-used; good trapping makes use of opportunities as they arise.
- Cost of traps can be offset by selling trapped pigs.
- Normal pig behaviour is not altered, which allows a greater number of the total population in an area to be removed.
- More humane to pigs and non-target species.

Disadvantages

- Can be time consuming and expensive to construct and maintain.
- Must be checked regularly.
- Not practical for large-scale control.
- Some pigs are trap shy.

Tips

- Stop all activities that will disturb normal feeding (i.e. do not undertake any shooting or dogging).
- Free feeding prior to activating traps is an essential part of successful trapping.
- Feeding sites should be placed where feral pigs are active (i.e. water points, holes in fences, areas containing old carcasses on which pigs have been feeding).
- Bait for traps must be food that pigs usually eat in that area. Pigs feeding on one crop (e.g. sugarcane) will often not take to alternative foods. However, new baits are sometimes attractive (e.g. fermented grains).
- The trap can be built around the feeding site, with feeding within the trap undertaken for several nights before it is set.
- Set the trap every night and check each day. If the trap cannot be checked daily then shade and water must be provided.
- Continue to trap until no more pigs are caught. A change of bait can be tried. Again, feed for one or two nights before re-setting the trap.
- Traps may be left permanently in locations used by pigs and can be pre-baited and activated when fresh signs of pigs appear.
- If the trap is to be moved, start feeding at the new site before re-locating the trap.

Design

There are several trap designs but all are principally an enclosed area with one-way gates (see Figure 1).

The main area of the trap can be any shape and be made from materials on the property. The best material is steel mesh with a grid 100 × 100 mm, with a minimum height of at least 1.5 m. Star pickets need to be placed no more than 1.5 m apart and imbedded far enough to ensure that adult pigs cannot push them over or lift them up out of the ground.

Alternative trap entrances

Funnel entrance

Formed by the two ends of the mesh forming a funnel, the ends are tied together at the top with wire or rope. The pig moves through the funnel forcing the bottom of the mesh ends apart and once it is in the trap the ends spring back together (see Figure 2).

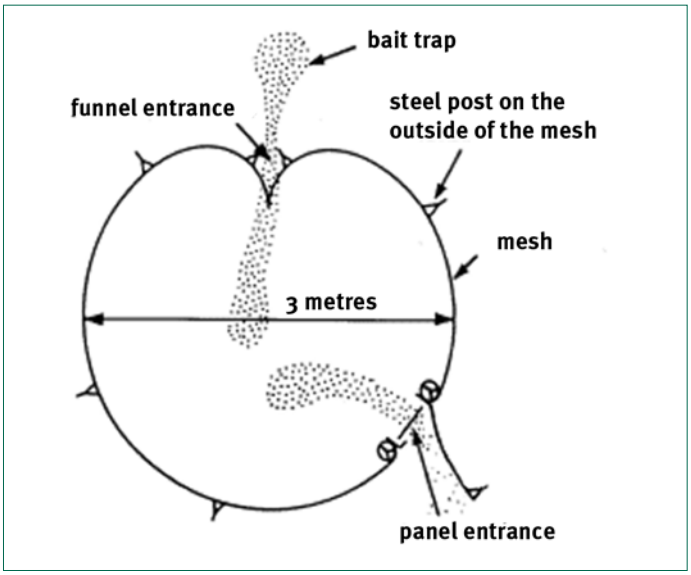

Figure 1. Alternative entrances

Tripped gate entrance

A side-hinged gate is pulled shut by springs and is held open by many systems that can be triggered to allow the gate to swing shut. Often trip wires are used, but many other systems have been tried. Most of these systems are not selective for feral pigs and can be triggered by any animal attracted to the bait. Once triggered the trap is no longer effective in trapping pigs.

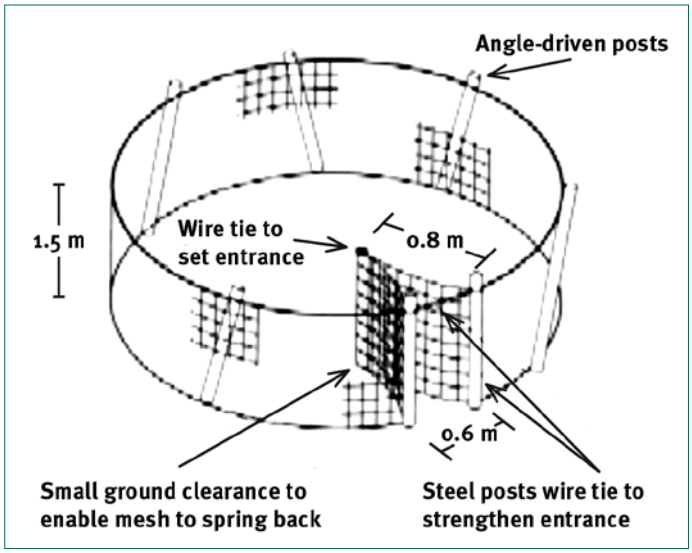

Figure 2. Silo trap with funnel entrance (14 m of silo mesh diameter about 4.5 m

Pig-specific trigger

By far the simplest and most effective trigger system has the gate held open by a bar (often a branch or piece of wood) which is hooked over the wire on the gate and on the side panel (see Figure 3).

Pigs rooting for feed in the trap lift the bar allowing the gate to swing shut. The specific feeding habit of pigs insures they are the only animals that lift the trigger bar.

The gate may be latched to prevent pigs from opening the door once triggered. However, this will prevent more pigs pushing their way in to join those inside.

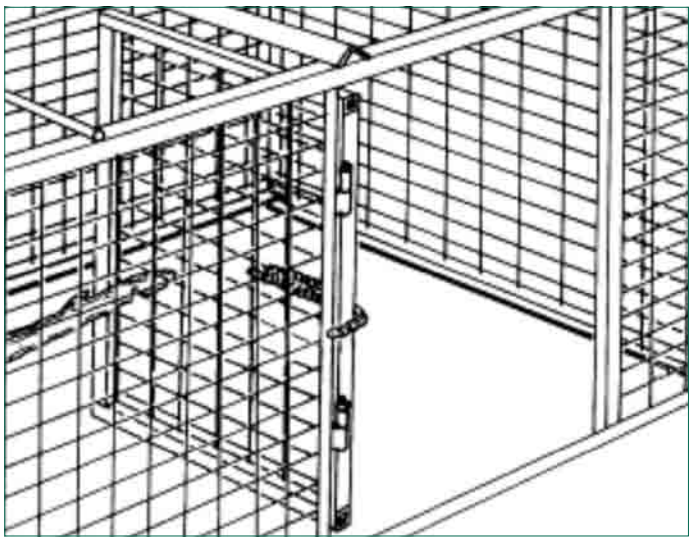

Figure 3a. Pig-specific trigger

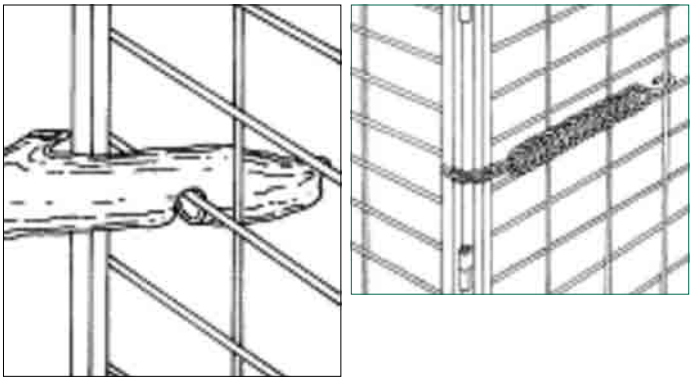

Figure 3b. Close up of pig-specific trigger

Poisoning

Poisoning is the most effective control method available that can quickly reduce a pig population.

Sodium fluoroacetate (1080) is recommended, but can only be supplied through persons authorised under the Health Act. Your local land protection officer or your local government office should be able to assist you.

Phosphorus-based poisons are available, but are not recommended as they are inhumane, less effective than 1080, and can result in poisoning of non-target species.

Pre-feeding is the most important step in poisoning operations. Free feeding with non-poisoned bait should be performed for several days prior to laying poisoned baits.

By selecting bait wisely, landholders can be species-selective in their poisoning program and avoid many of the unintentional effects of secondary poisoning.

Bait material such as fermented grains are very attractive to pigs but not to other animals, while it is a good idea to establish a free feeding routine so that pigs are the only animals feeding—they keep other non-targets away from the feeding site. Note that feral pigs are one of the few animals that will dig up bait.

Shooting and the use of dogs

Shooting pigs by helicopter is effective in inaccessible areas where pigs exist in reasonable numbers and are observable from the air.

The weapons recommended are shotguns with ‘buckshot’ (SG) cartridges and high-powered .308 rifles with a bullet weight in excess of 150 grains, preferably hollow point or soft point projectiles.

Ground shooting is not effective in reducing the pig population unless intense shooting is undertaken on a small, isolated and accessible population of pigs.

Dogs may be used to remove the few remaining pigs left after poisoning and trapping campaigns. Dogs are able to locate and flush pigs out of areas of thick cover.

Do not use dogs or shoot in areas before or during poisoning or trapping operations.

Fencing

Though an expensive option, fencing can offer successful pig control. Research has indicated that the most successful pig-proof fences are also the most expensive.

The most effective pig-proof fences use fabricated sheep mesh held close to the ground by plain or barbed wire and supported on steel posts.

Electrifying a conventional fence greatly improves its effectiveness if used before pigs have established a path through the fence.

Pigs will often charge an electric fence and unless the fence incorporates fabricated netting they often successfully breach the fence.

For crop protection or to avoid lamb predation, pig-proof fences need to be constructed *before* the pigs become a problem. Once pigs have adjusted to feeding on grain or lambs in a particular paddock fencing may be ineffective.

Diseases and parasites carried by pigs

Feral pigs are known to carry many diseases that can infect other livestock and be transmitted to humans.

Diseases most likely to affect people are:

- sparganosis—a parasite that can infest the muscles
- leptospirosis—a serious illness which causes very high temperatures, kidney problems and jaundice
- Q fever—a disease that can cause very high temperature and result in severe heart problems.

Q fever and leptospirosis have symptoms similar to Ross River fever, and can be contracted from contact with blood, meat and urine through broken skin, intake of urine-contaminated food or water, and inhalation of infectious air-borne organisms. Both can be fatal.

It is advisable to avoid handling feral pigs unless they are slaughtered at licensed premises where there is a full-time meat inspector on duty to ensure that animals are free of the above diseases.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

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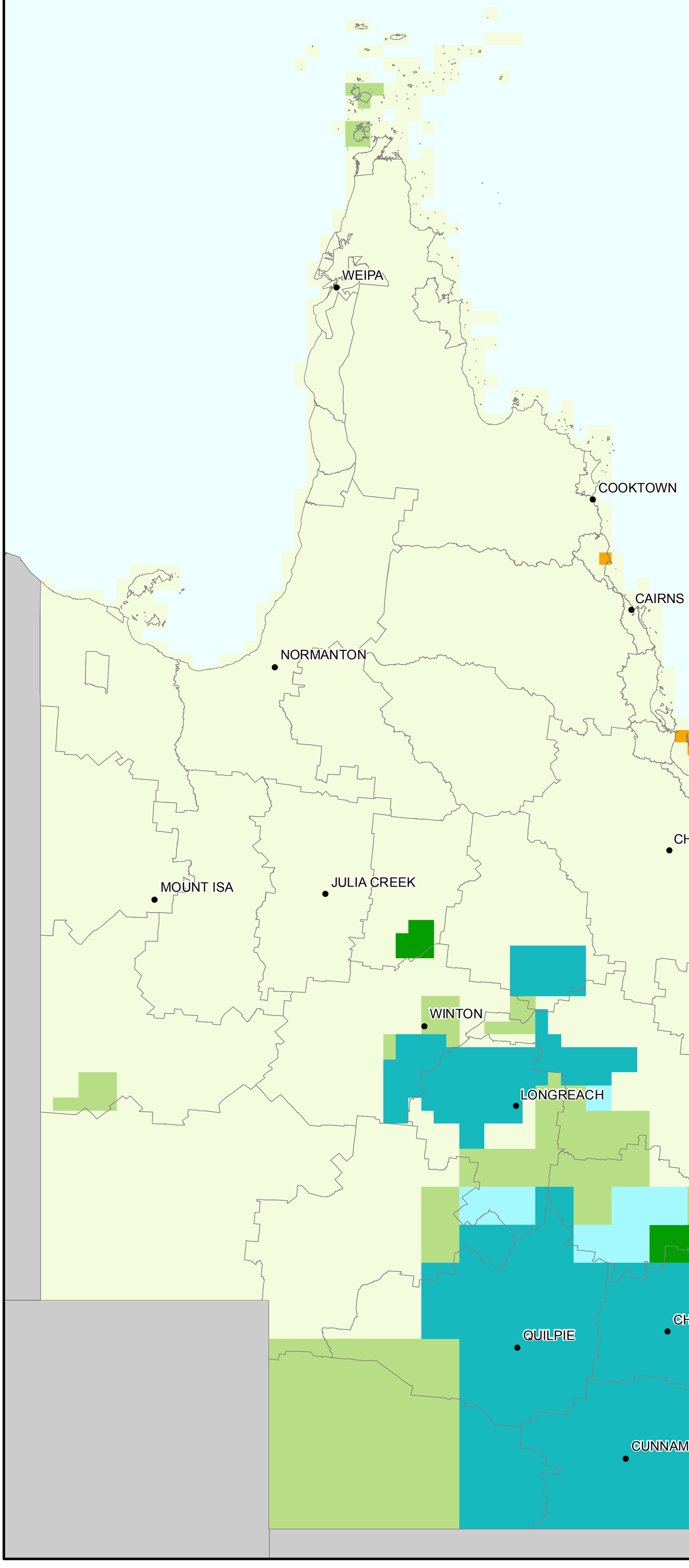
PR10–5206

A.11 Feral goat

FERAL GOAT

(Capra hircus)

QUEENSLAND DISTRIBUTION 2008



Queensland Government
Department of Primary Industries and Fisheries

APDS 2008

Density	*Distribution* Widespread	Localised
Abundant		
Common		
Occasional		

Absent

Unknown

LGA boundary

N

Digital data supplied by: Department of Primary Industries & Fisheries (DPI&F)

Map produced: Pest Information Management, Biosecurity Queensland, DPI&F

Whilst all care is taken in the preparation of these data, neither the Department nor its officers or staff accept any responsibility for any loss or damage which may result from inaccuracy or omission in the map or from the use of the information contain therein.

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PESTINFO

Fact sheet

DECLARED CLASS 2 PEST ANIMAL

Feral goat

Capra hircus

Declaration details

The feral goat is a declared Class 2 animal under the *Land Protection (Pest and Stock Route Management) Act 2002* and landholders are required to control its numbers on their land.

Managing feral goats is important to protect our agricultural industries and for wildlife conservation. Feral goats contribute to overgrazing, which can result in soil erosion and other forms of land degradation.

History

Goats were domesticated by 7500 BC and were valued for their ability to exploit land of low productivity and areas that could not be used by humans. Another advantage is that goats are easily controlled with little labour. Meat, milk products, and fibre are useful products.

Goats arrived in Australia with the First Fleet and were introduced to inland areas by early settlers, miners and railway construction gangs as a source of meat and milk. Herds were allowed to run free and many reverted to the wild.

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Angora and Cashmere goats were introduced in 1861 for a specialty wool trade. The venture failed because of competition and increased production from merino sheep and because of difficulties handling goat fibres.

Consequently, many pastoralists abandoned their goats and the genetic diversity of wild populations increased. Cashmere is produced by about 80% of Australia's feral goats with each yielding an average of 90 grams per clip.

Goats that survived after release or escaped from domestic herds are known as feral goats.

Habitat and distribution

Today, feral goats are present over much of Australia, with greatest numbers being concentrated in the semi-arid pastoral areas of Western Australia, western New South Wales, southern South Australia, and central and south-western Queensland. Australia has at least 2.3 million feral goats, with estimates of up to 240 000 feral goats in Queensland.

Feral goats are commonly found in rugged terrain that provides safety from pursuing predators such as wild dogs and humans. Other environments are colonised, but the isolation and comparative safety of ranges and semi-arid rangelands are preferred. Feral goats survive and breed in most habitats except rainforest, extensive wetland and desert areas.

Habitat selection is influenced by:

- availability of shelter (rock overhangs, caves, thickets of trees or dense scrub)
- adequacy of surface water supply
- abundance of preferred food species.

Predation by wild dogs clearly influences feral goat distribution.

Commercial use of feral goats

Feral goats are in demand for local and international markets. Meat and hides are valued. Some are exported live to countries in Asia and the Middle East. Feral goats are used to genetically upgrade commercial meat-production flocks and can be used for the control of weeds in some limited circumstances. Approximately 150 000 feral goats are harvested each year from central and south-western Queensland and killed at abattoirs. Feral goats are also field shot, as are feral pigs and kangaroos. These are processed through 'chiller boxes' located throughout Queensland.

Social behaviour and reproduction

In arid areas there appears to be no defined breeding season. In temperate areas mating tends to occur from January to June with a peak in February. The gestation period is 150 days.

Twins are common, and young are suckled for up to 60 days. Given favourable conditions, breeding may occur twice in one year. A female is capable of conception at six months provided body weight is more than 15 kg. Adult goats weigh about 45 kg for females and up to 60 kg for males.

Related females and their young form long-term associations within large herds—a matriarchal social organisation. Adult males form herds that associate with female herds during the breeding season.

Feral goats occupy a home range usually centred around a water supply. In arid areas, this range can be up to 379 km^2. In drier periods, when water is scarce, home ranges become small as animals remain close to permanent water.

Impact

Goats are generalist herbivores, eating a wide variety of plant foods. The highest quality food available is often selected.

As a selective browser, the feral goat can have a profound effect on a plant community over a relatively short period. In areas where the soil is of moderate to high fertility, changes in the balance of plant species in forests begins with the thinning-out of preferred understorey plants—leaving low-preference species untouched.

Through selective feeding, feral goats can reduce the diversity of plant species. Regeneration of some trees and shrubs may be prevented. Plants resistant to browsing and unpalatable species replace original forest.

The amount of vegetative cover may be severely depleted because of overuse and trampling by feral goats, leading to soil erosion. Feral goats compete with native fauna for food, shelter and water, particularly in semi-arid areas.

Feral goats are regarded as pests by some pastoralists because they compete with domestic livestock for resources. Overgrazing is a major contributing factor to land degradation in the mulga lands of Queensland. Feral goats, along with native and domestic herbivores, must be managed as one component of total grazing pressure.

The cost of feral goats is unknown. At least $17 million is lost to the Australian sheep industry through competition between feral goats and domestic sheep.

Disease

Feral goats are susceptible to devastating exotic livestock diseases including foot-and-mouth disease, scrapie, rinderpest, Rift Valley fever, rabies and blue tongue. Unchecked, wild herds could play a major role in the spread of infection and act as a reservoir if these diseases are introduced to Australia.

Feral goats are prone to a number of diseases currently in Australia including Q fever, tetanus, leptospirosis, brucella melitensis, hydatids, pulpy kidney, blackleg, and various parasitic worms of the gastro-intestinal tract.

Control

A population of goats is capable of doubling in size every 1.6 years in the absence of death caused by human control activities. To prevent populations from increasing, approximately 35% of the population must be removed each year.

For commercial goat harvesting operations to be viable, capture methods must be economical. More expensive methods may be justified in the control of exotic diseases or for environmental protection.

Feral goat control or management depends on market influences. In times of good prices, feral goats are harvested. When prices or feral goat densities are low, little control is undertaken. Effective management of feral goats for agricultural or conservation benefit must be ongoing and cannot rely on market forces.

Feral goat management is more effective when combinations of techniques are used and control is carried out over large areas.

Mustering

Mustering by motorcycle or horse with the aid of dogs may achieve good results, especially if employed by local residents who opportunistically take advantage of the tendency for feral goats to aggregate into larger herds.

It is important to muster only that number of goats that can be confidently handled. Escapees can become cunning, and retreat from the herd or go to ground at the next muster.

Shooting

Ground shooting is labour intensive but can produce good results if control programs are well planned and the effort is maintained. Helicopter shooting is extremely effective and can result in a rapid and substantial reduction in goat numbers when there is no extensive cover in the form of dense scrub, caves, or rock piles.

However, helicopter shooting is expensive and is used only when the need for a reduction in feral goat numbers is great and when cheaper alternatives are not available.

Trapping

Goats may be trapped at water if alternative watering points are not available. Traps consist of a goat-proof fence surrounding a water point that is entered through one-way gates or ramps. There are a variety of designs for these gates or ramps, which permit the goats to enter, but not to exit. These traps can also be used for domestic stock management. It may be possible to close off troughs and dams and thereby direct goats to a central watering point.

Trapping using food as an attractant has been found to be unsuccessful.

Judas goat

It is difficult to find goats in areas where moderate to dense vegetation and hilly terrain impedes visibility. To overcome this problem the 'Judas goat' technique can be used.

Feral goats are fitted with radio transmitters and then can be located with directional receiving equipment. Goats are social animals and when a goat carrying a radio transmitter is released in an area known to contain feral goats, it will join up with the herd.

The radio collared 'Judas' goat is then tracked and local feral goats are shot. The Judas goat can be allowed to escape and the process repeated.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

PR10–5198

A.12 Red Fox

Fact sheet

DECLARED CLASS 2 PEST ANIMAL

European red fox

Vulpes vulpes

Declaration details

Under the *Land Protection (Pest and Stock Route Management) Act 2002*, the fox is a declared Class 2 pest animal and it is the responsibility of landholders to control foxes on their own land. Foxes cannot be kept in captivity or introduced to Queensland without a permit.

Description and general information

The most common and widespread of the world's many fox species is the European red fox (*Vulpes vulpes*). Foxes are a major pest species in Australia that threaten agricultural and native species alike. Foxes have pointed muzzles, flattened slender skulls, large ears and long bushy tails. Adult male foxes weigh around 6 kg, while females weigh about 5 kg.

Habitat and distribution

The European red fox was deliberately introduced into Australia in 1845. First released near Melbourne for sporting purposes, it spread rapidly. By 1893, it had become a nuisance in north-eastern Victoria and by 1930 it occupied most of southern Australia.

Next to wild dogs, the fox is the largest land-dwelling carnivorous mammal in Australia. Foxes are adapted to a variety of different habitats, ranging from deserts to urban environments. However, foxes are not found in tropical Australia. Competition with dingoes, climatic preferences and food supply likely determine their distribution.

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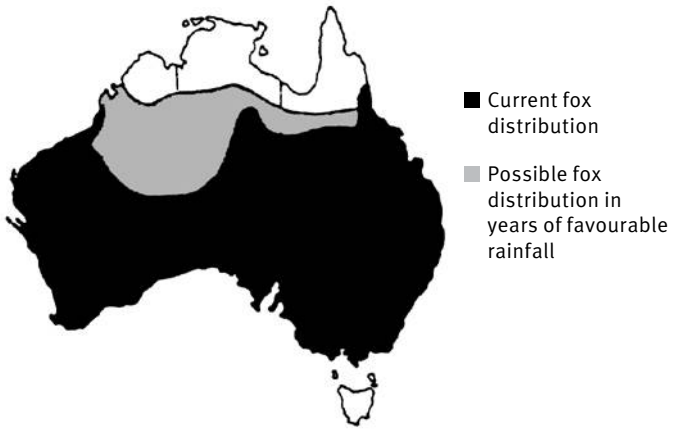

Current distribution of the European red fox

Diet

Foxes in Queensland are primarily carnivorous (meat-eating) scavengers and opportunistic predators. Although they consume a varied diet of rabbits, rodents, frogs, birds, insects and even fruit, most of their diet in Queensland consists of kangaroo and sheep carrion.

Fox predation is considered the greatest threat to the long-term survival of many small marsupial species in Australia. Long-term studies have shown that rock wallaby and malleefowl populations are probably regulated by fox predation. Predation on birds and reptiles appears seasonal.

Growth and reproduction

Foxes breed once a year. Over a period of 2–3 weeks in early winter females come into oestrus for 2–3 days. Males appear to be fertile throughout winter and early spring.

The fox's gestation period is 51–53 days. Cubs are generally born in burrows but litters have been found in hollow trees, rock crevices, under houses or in stick-rake piles. Litter size ranges from 4–10.

Although red foxes have generally been considered monogamous, communal denning has now been recorded, as well as the presence of 'helpers' at the den.

The proportion of vixens that breed varies greatly between areas (ranging from 30% to nearly 100%).

Fox populations can withstand up to 75% yearly mortality rates and recover to pre-control population levels. Recovery rates are dependent on immigration rates and breeding.

Behaviour

Foxes generally disperse from where they were born in autumn at 6–9 months of age. Dispersal behaviour varies between males and females and between individuals of the same litter. Females generally disperse 3–15 km and males 11–43 km, although distances of 170 km have been recorded.

Foxes were previously thought to be solitary, but recent evidence suggests that fox family groups occupy well-defined home ranges. Rural home ranges in Australian are about 500 ha; however, this depends on resource availability.

Foxes are usually active at night and rest during the day in an earth den (often an enlarged rabbit burrow), thicket, hollow log or stick-rake pile. In winter, when there is less food available, foxes may hunt and scavenge during the day.

Although paths may cross many times each night, foxes within a group tend to forage in different parts of the group's territory. Dominant animals monopolise the best habitat.

Faeces and urine are used to define territories by scent marking conspicuous landmarks like tussocks of grass and rabbit warrens. These scent marks are distributed throughout the fox's range, especially in places that are visited often. Dominant animals scent mark with urine more than subordinates.

Foxes communicate by sound as well as by scent marking and body language. Young foxes use aggressive yapping and a resonant howl during the winter mating season. Vixens and pups will bark and whimper softly. Adult foxes also scream.

Causes of mortality

Mortality of young foxes is generally high, with up to 80% dying in the first year. Poisoning, hunting, roadkills, disease, food shortage and social factors contribute to mortality.

Most foxes live less than four years, although eight-year-old foxes in the wild have been reported. Mange and distemper are thought to be important causes of mortality in wild fox populations; however, little is known about their role in regulating Australian fox populations.

Predation on livestock

In some circumstances red foxes may kill lambs and goat kids. Fox predation on healthy, viable lambs is generally less than 5%; however, this varies between properties. Individual rogue foxes can cause high stock losses. Furthermore, red foxes, as well as dingoes/wild dogs, are noted for 'surplus killing' and will kill multiple easy prey animals despite an abundance of carrion.

Foxes usually attack the throat of lambs and kids, although some are killed by multiple bites to the neck and back. This may result from young animals being caught while lying down. Foxes do not have the size and strength to hold and immobilise adult sheep or goats, or to crush large bones; therefore, repeated bites may be required to subdue prey.

Foxes generally prefer large internal organs and begin feeding through an entry behind the ribs. However, some

target the nose and tongue and may consume the head of small prey. Red foxes are noted for carrying small carcases back to their dens to feed their young, which may account for some poultry, lambs and kids that disappear and are never found.

One way to distinguish fox kills from wild dog attacks is that foxes rarely cause severe bone damage to stock. Poultry can, however, be badly damaged through fox attacks.

Urban foxes

Both in Australia and overseas foxes readily survive and prosper in urban environments. Fox densities in Melbourne are reported to be as high as 16 per km^2 compared to densities generally less than 2 per km^2 in most semi-arid grazing areas.

The distribution of urban foxes depends on the availability of suitable daytime hiding places. While foxes in urban areas are generally found in remnant bushland or parks, foxes can find refuge under railway platforms, houses or sheds, or in quiet gardens. The availability or distribution of food supply in any given habitat will also affect the distribution of urban foxes. Bushland areas in and around cities provide ideal shelter.

In urban areas, foxes eat a diversity of food types including small birds, worms, insects, fruit and food put out by residents.

Urban foxes will rarely attack people. However, any urban fox is a wild animal and should be treated as such.

Urban foxes can be a nuisance by:

- attacking poultry and livestock in people's yards
- raiding garbage bins scavenging for food
- digging holes in lawns while scavenging for food
- causing domestic dogs to bark.

Rabies threat

Foxes, along with other feral animals, have the potential to spread diseases such as rabies, should such diseases ever be introduced into Australia. They would also provide a reservoir of infection, making rabies almost impossible to eliminate.

Rabies is a contagious disease of virtually all mammals, including humans. Once symptoms of rabies appear, the virus is almost always fatal to both humans and animals.

This deadly virus is not established in Australia but is present in Asia.

However, we should not be complacent about the rabies issue. All foxes are capable of contracting and spreading rabies. In the Northern Hemisphere red foxes are the principal vectors and victims of the disease. Millions of foxes have been culled overseas in unsuccessful attempts to control the disease.

Control

Current options available for control of foxes in Queensland include poisoning, trapping, shooting, guard animals and exclusion fencing. The choice of control method should suit the individual circumstances. The potential of M-44 mechanical toxin ejectors and fertility control, such as immunocontraception, is also being researched.

Poisoning

Presently there are two poisons legally available for fox control in Queensland—sodium monofluoroacetate (1080) and strychnine.

1080 poison baits are the most economical and effective method of controlling foxes. Processed (FOXOFF®) or fresh meat baits can be laid quickly by hand, vehicle or from the air, with population reductions of greater than 90% recorded from some baiting campaigns.

Baits should be placed along track and fence lines 200–500 m apart, 8–10 cm underground and covered with loose soil. Burying baits has the advantages of reducing non-target bait take (more baits for foxes) and protecting baits from the elements. All property neighbours should be notified at least 72 hours prior to baiting, and baiting signage should be erected at every property entrance and left for at least one month after baiting. Based on fox biology, the optimum time to bait is in November followed by June/July when food demand is highest (this coincides with lambing on many properties). Foxes are also often killed by 1080 baiting programs that are designed primarily to control wild dogs or feral pigs. FOXOFF® or meat baits can only be obtained through licensed Biosecurity Queensland officers and local government operators.

Queensland and Western Australia are the only two states that have not outlawed the use of strychnine for controlling foxes based on target specificity and humanity issues.

A Queensland Health permit is necessary to purchase strychnine. Cyanide capsules are currently being evaluated as an alternative toxin to strychnine.

Baits can be selectively positioned or tethered to avoid killing native non-target species. This is particularly important in areas containing native carnivores such as quolls. A fox's keen sense of smell enables it to find baits intentionally buried in sand or otherwise hidden.

To effectively reduce the short- and long-term impact of foxes, it is highly recommended that baiting activities be coordinated among adjoining properties. Baiting of individual properties will only provide short-term success due to the high mobility of foxes and will result in rapid re-invasion.

Trapping

Trapping is time consuming, labour intensive and generally ineffective for reducing fox populations. The success of trapping (using Soft-Catch® traps and snares, not illegal steel-jawed traps) depends on the skill of the operator. Trapping is predominantly used in urban areas where poisoning and shooting are restricted, where there is high risk to native species, or for live-capture research purposes.

Shooting

Shooting of foxes is a highly selective, popular and widely used control technique in rural Australia. Fox shoots are normally carried out at night from a vehicle using a .222 calibre rifle with the aid of spotlights. Although the success of this method varies, depending on the shooter's marksmanship and the wariness of the foxes, the technique is still considered ineffective for reducing fox populations over the longer term. Furthermore, the practice is biased towards young unwary juveniles and may do little to reduce the impact of foxes on lambs or wildlife. Shooting is best performed in addition to other control techniques.

Guard animals

Guard dogs, primarily maremmas, and alpacas are used to protect sheep and goats from fox predation in numerous countries, including Australia. The effectiveness of guard animals in reducing fox predation on lambs and goat kids is primarily unknown. Consequently, guard animals should not replace other control techniques until the technique is proven successful.

Although dogs have traditionally been used for guarding, alpacas have the added advantage of being herbivores and therefore do not require additional feeding. They are also less likely to wander and become problem animals themselves. This control technique is most suited to small properties on the urban fringe.

Exclusion

Exclusion fencing for foxes is expensive and fences must be well maintained due to the agility of foxes and their ability to squeeze through small holes. Fencing is most often used to protect high value stock, poultry or wildlife from fox predation in areas where other control methods cannot be used (i.e. in closely settled areas).

Secure poultry runs and night yards for small livestock should be considered in areas where foxes are a problem. Foxes can dig and climb so runs and yards need to be constructed with this in mind.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

PR10–5190

A.13 Mosquito

Operational policy

Pest management

Mosquito and biting midge control

Operational policies provide a framework for consistent application and interpretation of legislation and for the management of non-legislative matters by the Department of Environment and Resource Management, (incorporating the Queensland Parks and Wildlife Service). Operational policies are not intended to be applied inflexibly in all circumstances. Individual circumstances may require a modified application of policy.

Policy subject

Under what conditions will Queensland Parks and Wildlife Service (QPWS) authorise the control of mosquitoes and biting midges in QPWS managed areas?

Background

Mosquitoes are native insects that breed in salt, brackish or fresh water. Midges breed in substrate generally associated with wetlands such as intertidal areas and the banks and flood plains of streams and rivers. Larvae and pupae of mosquitoes and biting midges can be an important food source for aquatic animals. Mosquitoes and biting midges contribute to the biological diversity of natural areas.

More than 220 mosquito species can be found in Queensland. A substantial number of these have been implicated as vectors of some human diseases. Midges have not been implicated in the transmission of human diseases, though they can present a problem to humans through nuisance biting and have been identified as vectors for arboviruses of livestock overseas.

The *Health Regulation 1996* provides local governments with the statutory support to undertake mosquito control programs to reduce the incidence of vector-borne disease. At the same time, QPWS has a charter to conserve nature and protect native species and their habitats, including mosquitoes and midges.
Direct control of mosquitoes and midges can be undertaken by habitat modification, biological control, or in some cases, by the use of chemicals. The Australian Pesticides and Veterinary Medicines Authority (APVMA) evaluates the appropriateness of chemicals for such control in relation to environmental issues associated with their use.

Indirect control can be achieved by town planning to restrict development near or downwind of mosquito or midge breeding sites, building appropriate housing styles (e.g. elevated vs. lowset), using insect screens, using mosquito nets, protective clothing and personal repellents and avoiding areas at certain times of the day or year when biting insects are likely to be a problem. Personal protective measures can be the most effective way to prevent the spread of vector-borne diseases.

Where human activity has created mosquito breeding habitats on QPWS managed areas, QPWS may undertake management programs to reduce mosquito breeding using the most ecologically sustainable techniques.

Queensland Government

Department of Environment and Resource Management
www.derm.qld.gov.au ABN: 46 640 294 485

Definitions

Abate (temephos) is an organophosphorous insecticide which is non-specific in its action and has acute toxic affects on a wide variety of aquatic organisms. Was once used extensively to control mosquitoes in Moreton Bay but was generally replaced in the 1990s with the more specific agents of s-methoprene and *Bti*.
adulticiding involves spraying insecticide in a fine mist, targeting adult mosquitoes.
approval is written official permission.
arbovirus is an arthropod-borne virus.
biological agents include control agents which kill or inhibit the growth of target organisms, but do not self-perpetuate in the wild (such as bacterial products).
biological control is the artificial control of pests and parasites by use of organisms, or their products, which naturally reproduce to control the population of other organisms.
biopesticides are hormones, enzymes or other naturally occurring chemicals which can be used to control pests.
biting midges are biting insects belonging to the family *Ceratopogonidae*.
Bti is a biological agent (bacterium) called *Bacillus thuringiensis* var*. israelensis* that is specific in its action, having toxic effects on larvae of mosquitoes when ingested.
habitat modification involves larger scale earthworks or vegetation removal often involving the construction of deeper ditches to increase tidal flushing and reduce ponding in upper intertidal areas.
nuisance biting are the effects of mosquitoes and midges, resulting in discomfort and skin irritations.

QPWS managed areas include the following areas:

- protected areas (State land) under the *Nature Conservation Act 1992*
- State forests and other lands managed under the *Forestry Act 1959*
- Recreation Areas under the *Recreation Areas Management Act 2006*
- Brisbane Forest Park under the *Brisbane Forest Park Act 1977*
- Marine Parks under the *Marine Parks Act 2004*
- other areas where QPWS has control, trusteeship or otherwise manages the land.

runnelling involves small scale habitat modification through the creation of shallow, spoon-shaped channels (maximum depth 30cm) that take advantage of existing topography and drainage lines to enhance tidal flushing of mosquito breeding areas in the upper intertidal zone.
S-methoprene is an insect growth regulator that disrupts the maturation process of mosquito larvae, preventing them from pupating and reaching the adult (vector) stage of their life cycle.

serious health risk is demonstrated by recorded cases of notifiable arbovirus infections (such as Ross River virus) or large numbers of mosquito species that are known or possible vectors of arbovirus.
vectors are organisms capable of carrying and infecting other organisms with a bacteria, virus or parasite.

Determination

A State government or local government agency (or their agent) can undertake mosquito control activities on QPWS managed areas where a state of disaster has been declared under the *Disaster Management Act 2003* and the District Disaster Co-ordinator determines such action is necessary to ensure public safety or prevent or minimise loss of human life. No permit is required in this instance.

QPWS prefers and will promote indirect control of mosquito and biting midge problems.

However, an approval for direct control may be issued where a health authority considers an emergency situation or serious health risk exists, or a government department or local government authority propose control activities where the primary aim is to reduce the incidence of vector-borne disease.

Application assessment and decision

Applications will be assessed against the criteria in Appendix A before a recommendation is made to the delegate. If approved, a permit will be issued under the legislation relevant to the target area.

Approval conditions

All permits issued for this purpose will contain a condition that requires the permitted activity to be undertaken in conformity with the *Mosquito Management Code of Practice for Queensland – 2002*. Conditions will also be added to address ecological protection and public interest issues relevant to the target area.

Control measures

Only the following control measures may be permitted:

- source reduction − the removal/eradication of container breeding sites generally associated with human habitation. This should occur as a preventative measure.
- biological control – natural biological control is the preferred method of direct control for mosquitoes and biting midges on QPWS managed areas. Biological agents may include fish and other aquatic species. However, only fish approved by the DPI and native aquatic invertebrates may be used.
- land or aerial application of pesticides − only APVMA registered chemicals are to be used for chemical control activities.
- runnelling – only approved in protected areas when the health risk is serious and no control measure with less environmental impact is available. It will be subject to consideration of the conservation values of the QPWS managed area.
- habitat modification – may be permitted in marine parks only when the health risk is serious and no control measure with less environmental impact is available. It will be subject to consideration of the conservation values of the QPWS managed area. Will not be permitted in Protection Zones.
- adulticiding (fogging) – generally not an acceptable control for mosquitoes and biting midges in QPWS managed areas, but may be used as a method of last resort to kill adult mosquitoes within urban areas where there is a serious health risk and alternatives have been exhausted.

Other matters to consider

To the greatest possible extent, insecticides used to control mosquitoes in areas under this policy are to be based only on microbial insecticides developed from the bacterium *Bacillus thuringiensis* or alternatively insect growth regulators specific to mosquitoes ('S-methoprene'). These substances have a low toxicity to non-target species, present the lowest environmental hazard and therefore should be the standard for any chemical control of mosquitoes on QPWS managed areas.

Temephos (Abate®) is registered for mosquito control but is not generally accepted for use in control programs. It should not be applied in shallow lakes (less than 30cm deep) and is no longer registered for control of biting midges. Its use in QPWS managed areas (including marine parks) should be generally prohibited except as a last resort, as it has implications for Workplace Health and Safety because it is a 'hazardous substance' (see

Workplace Health and Safety Regulation 2008 – Schedule 6). (Also refer to comments on *temephos* in the *Procedural Guide: Mosquito and biting midge control*.)

There is currently no registered chemical for biting midges in Australia. The APVMA does issue 'off label permits' to use organophosphates such as Malathion for the control of biting midge in artificial waterways, such as canal estates with sand beaches. However, the use of such chemicals in natural waterways is generally considered inappropriate and they should not be used in QPWS managed areas.

Additional Information

Procedural Guide: Mosquito and biting midge control

Approved by

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Signature	Date

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Appendix B Wash-down and Inspection Procedures

B.1 Wash-down Checklist and Logbook

Example of a weed wash-down checklist for cars and trucks

Activities Date[1]							
Step 1 vacuum or brush out the interior of the car and shake down personnel clothing and footwear (required if personnel were working in known weed infested area, in an area where weed were observed, or in a muddy or wet area)							
— Check foot wells, door pockets, anywhere that may hold seed							
— Check carpet for any burrs or sticky seeds or mud stuck in carpet carrying seed.							
— Check under any removable carpet or foot mats.							
— Check boot if any equipment has been used in weed infested areas							
— Remove any seed or mud capable of holding seeds from clothing and footwear							
Step 2 Wash down the vehicle with preference for a low pressure, high volume hose (high pressure hoses or car washes can be used if an inspection is carried out afterwards and follow up hosing if required). Areas requiring attention;							
— Radiator, grill, roo bar							
— Top of transmission gearbox							
— Wheel arches, wheel trims, tyres and rims							
— Mud flaps							
— Bumpers (get in behind)							
— Axels and diffs							
— Spare tyre (if external)							

— Door seams							
— Step treads							

[1]Date and check the boxes during wash-down and inspection.

Example of a weed wash-down log book to be carried in every vehicle.

Please note daily locations and work undertaken. Please complete table as indicated to show risk of weed exposure. Requirements for weed wash-down should be determined using the matrix on the next sheet. If a wash-down is carried out please use the check list on the back of this sheet.

Date	Activities and location	Wash-down required (If no, why? Refer to matrix)	Time, date method and location of wash-down	Washer's signature
		Y / N why?		

B.2 Weed Hygiene Declaration

Weed hygiene declaration

Part 1 – Sale or supply of things

(Examples of 'thing' include fodder, grain, seed, livestock, gravel, sand, soil, mulch, packing material, machinery, vehicles, or water)

This declaration is valid for supplying thing/things specified below from _____ to _____ (please provide dates)

1. Thing (please tick the relevant box and provide a brief description)

☐ Fodder ☐ Grain/seeds ☐ Sand/gravel ☐ Machinery ☐ Mulch ☐ Livestock ☐ Other

Amount _____ (e.g. weight, size of load, number of items)

Description _____ (e.g. cattle, hay, dozer)

2. Has the 'thing' been moved through, stored in, come from, or used in a place infested with:

	Yes	No	Maybe
Parthenium	☐	☐	☐
Giant rat's tail grass, American rat's tail grass, giant Parramatta grass, Parramatta grass	☐	☐	☐
Prickly acacia	☐	☐	☐
Other (provide details)	☐	☐	☐

3. If you answered 'yes' or 'maybe' in question 2, then what actions have been taken to remove or ensure that there is no reproductive material (please tick the relevant boxes and specify steps taken)

☐ Nil ☐ Washing/cleaning ☐ Quarantine period ☐ Chemical treatment ☐ Certified clean _____ Other

Steps taken _____

4. To the best of my knowledge the 'thing' described above: still contains a weed listed in 2 above

☒	☐	☐

I _____ of _____

Town _____ State _____ Telephone _____

Declare that the information that I have provided in this declaration is true and correct and I have read the accompanying explanatory notes before completing this Declaration.

Signature _____ Date _____

Part 2 – Transport of contaminated things

(Vehicle includes anything used for carrying anything or any person by land, water or air, and includes equipment or machinery capable of moving on land).

This declaration is valid for transport and movement of vehicles and other things from _____ to _____ (please provide locations)

1. Movement of vehicles. The vehicle described as: Make _____

Registration no. or engine/frame no. _____ Was *clean prior to entry to _____ (destination)

*Please refer to the definition of clean in the explanatory notes

2. Transport of contaminated things. If you are transporting anything contaminated or possibly contaminated with any declared weed, what actions are being used to contain the weed reproductive material:

☐ Nil ☐ Covered with tarpaulin ☐ Enclosed within container ☐ Chemically treated _____ Other

Actions: _____

I* _____ of _____

Town _____ State _____ Telephone _____

*If same as Part 1 please write 'as above'

Declare that the information that I have provided in this declaration is true and correct and I have read the accompanying explanatory notes before completing this Declaration.

Signature _____ Date _____

Explanatory notes

This declaration was developed in response to landholders, rural industry, community and government desire to minimise the impact of weeds on their business and on the environment. It has been developed to assist in preventing the spread of weeds and other contaminants, and to meet the requirements of Section 45 of the *Land Protection Act (Pest and Stock Route Management) Act 2002*. Completed it provides information on the status of a 'thing', whether it is contaminated or free of weedy material. Part 1 – Sale or Supply of Things of the declaration should be completed by the supplier then given to the receiver before they receive the 'thing'. The receiver can then make an informed decision and take precautions to prevent new infestations. It can also provide written assurance that a vehicle is clean before entering a property.

Why use this declaration?

This declaration can provide:

- A supplier a way of meeting the requirements of section 45 (2) of the Act, if they are supplying any thing that is, or could be contaminated with the weeds listed below.
- A person obtaining a 'thing', information on whether the thing is clean of weed reproductive material or has been infested.
- Assurance that a vehicle was *clean prior to entry onto a property.
- Assurance that any contaminated or potentially contaminated thing is being moved so as not to spread the contaminant.
- Assurance that a product is free of other weedy reproductive material.

Section 45 of the Act makes it an offence to supply a 'thing' that is contaminated with a Class 1 or any of the Class 2 weeds listed below. However, for the Class 2 weeds, a person does not breach Section 45, if they provide a written notice (Part 1 of this declaration) that states that the 'thing' is or may be contaminated. The written notice must be filled and given to the receiver before the 'thing' is supplied.

List of Class 2 species

The following class 2 pests are prescribed for section 45(1)(b) of the Act. These weeds are readily able to infest a wide range of products, from livestock to grain and vehicles. These weeds have a major effect on pasture production and have the capacity to invade large areas of Queensland.

Common name	Species
American rat's tail grass	*Sporobolus jacquemontii*
Giant Parramatta grass	*Sporobolus fertilis*
Giant rat's tail grass	*Sporobolus pyramidalis* and *S. natalensis*
Parramatta grass	*Sporobolus africanus*
Parthenium	*Parthenium hysterophorus*
Prickly acacia	*Acacia nilotica*

Across Queensland, isolated outbreaks of declared plants such as those listed above are found on properties and roadsides each year. Outbreaks of these declared plants are often located hundreds of kilometres from core infestations. These outbreaks occur as a result of machinery, livestock, vehicles, fodder, grain, material and equipment contaminated with weed seeds being transported across the state. A high percentage of seed from prickly acacia and giant rats tail grass remains viable after being eaten and excreted by cattle.

***Definitions**

Clean

- For vehicles, machinery and equipment, clean means that no soil and/or, organic matter that may contain weed reproductive material, is on or in areas that are accessible during cleaning and maintenance work. A checklist and guidelines that show areas that are required to be clean are located on www.dpi.qld.gov.au.
- A vehicle is considered to remain clean if it leaves its point of origin clean and only travels on sealed roads or well maintained unsealed roads.
- For livestock, clean means that animals are internally and externally free of the reproductive material of any declared plant listed in the Land Protection (Pest and Stock Route Management) Regulation 2003. If livestock are suspected to be infested with a declared weed then they should be quarantined within a weed free paddock or pen for a 14-day period.

Weed reproductive material: means any part of the plant that is capable of producing another plant, this can be by sexual and asexual reproduction. Examples include seeds, bulbs, rhizomes, tuber, stem or leaf cutting and the whole plant.

Well-maintained unsealed road: means roads that do not have vegetation growing on or encroaching onto the area occupied by traffic.

For further information: Please contact the relevant Local Government Weeds Officer or the local office of the Department of Primary Industries and Fisheries.

Queensland Government
Department of Primary Industries and Fisheries

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