

Technical information supporting the 2018 land: invasive species (abundance and distribution of established invasive species) trend and condition report card

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Government of South Australia

Department for Environment
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Contents

Consultation and acknowledgements	ii
Contents	iii
Summary	v
1 Introduction	1
1.1 Invasive species in our terrestrial environments	1
2 Methods	2
2.1 Indicators	2
2.2 Data sources	3
2.3 Trend	4
2.4 Condition	4
2.5 Limitations	5
2.6 Reliability	5
3 Results	7
3.1 Reliability	7
3.2 Whole-of-state	7
3.3 Natural resources management regions	8
4 Discussion	11
4.1 Trend	11
4.2 Condition	12
4.3 Future reporting	13
5 References	15

List of figures

- Figure 4.1 Trends over time of the per cent of surveys that observed invasive vertebrates. These graphics have not been fully developed, results need to be reviewed before calculations are used for invasive species assessment. 14

List of tables

Table 2.1.	Key invasive species that are addressed in the report	2
Table 2.2.	Definition of trend classes used.....	4
Table 2.3.	Definition of condition classes used	5
Table 2.4.	Guides for applying information currency.....	5
Table 2.5.	Guides for applying information applicability.....	5
Table 2.6.	Guides for applying spatial representation of information (sampling design)	6
Table 2.7.	Guides for applying spatial representation of information (sampling design)	6
Table 3.1	Information reliability scores for numbers of incursions of diseases and invasive species.....	7
Table 3.2	State scores for key invasive species.....	7
Table 3.3	2017 condition and trend score for each NRM region – scored by NRM regional experts	8
Table 3.4	Qualitative results of surveys: trend of invasive species in each NRM region for the five year period from 2013–17	9
Table 3.5	Distribution of invasive species as a percentage of each NRM region based on BDBSA supertable records from 2000–17	10

Summary

This document describes the indicators, data sources, analysis methods and results used to develop this report and the associated report card. The reliability of data sources for their use in this context are also described.

1 Introduction

1.1 Invasive species in our terrestrial environments

Invasive species are animals, plants, parasites or disease-causing organisms that become established outside their natural range and become pests (IUCN 2000). This trend and condition report looks at the distribution and abundance of key invasive species that have established populations in the terrestrial environments of South Australia. Related report cards on biosecurity on land, biosecurity and invasive species in inland waters, and biosecurity and invasive species in marine and coastal environments can be found in the [SA trend and condition report cards 2018](#).

Invasive species have an economic, environmental and social impact on agriculture, biodiversity, natural and built environments, public health and productivity (Bomford 2008). Invasive species compete with crops, pasture, livestock and our native plants and animals. They contribute to land degradation, reduce farm and forest productivity, contaminate crops and grains, increase bushfire fuel and can be toxic to people, livestock or native animals (Department of the Environment and Energy 2016). Weeds and pest animals also impact cultural sites, for example camels can foul and denude waterholes.

Weeds are estimated to cost the Australian economy \$4 billion per annum in direct management and production losses (Sinden *et al.* 2005), and in 2013–14 pest animals were estimated to cost \$743 million per annum (McLeod 2016). Monitoring and evaluating pests provides on-ground information to natural resource managers so they can respond appropriately to community, economic and environmental needs. On average, 80 per cent of farmers in South Australia manage weeds and pest animals and the average farms spends about \$19,000 per annum (ABS 2007).

Controlling invasive species is a responsibility of landholders. The Government of South Australia oversees programs to support landholders to destroy or contain invasive species to provide a policy framework to prevent new pests coming into South Australia. Typically the management of weeds and pest animals is based on a risk assessment of their potential impact and spread, and the cost to contain the pest. For example, if the species is widespread, management actions are to protect assets. If the species is localised or in small numbers, management actions are to eradicate species. The percentage of weed programs that met their objectives ranged between 53 and 57 per cent between 2012–16. Over the same period 63 to 100 per cent of pest programs achieved their management objectives (DEWNR 2017).

This report card will address some of the declared plants and animals that are established in South Australia (see Table 1). Key species are selected by NRM and PIRSA officers, based on current policies, regulations and perception of existing or potential impact as defined by risk assessments.

2 Methods

2.1 Indicators

Indicator to assess trends of invasive species in terrestrial environments of South Australia is the distribution and abundance per species per NRM region. Trend was scored based on qualitative survey data that addressed change in distribution key taxa over a 5-year period (2013–17), which was integrated to provide regional and whole-of-state summaries. Condition score, provided by Biosecurity SA, is based on the criteria regarding current impact on natural landscapes and primary industries.

Key invasive species included in this assessment were those identified by DEW and PIRSA staff, based on policies and legislation by the state and federal government, including the [South Australian Livestock Act 1997](#), the [Natural Resources Management Act 2004](#), Weeds of National Significance, Pest and Weed Risk Management processes and the Weed Control Handbook. Pest animal species in the report card are those considered to be pests of national significance by the Vertebrate Pest Committee (VPC) (wild dog, rabbit, fox, cat, starling, goat, deer and pig) mice and camels. Camels, although not included on the VPC assessment as one of the highest priority species, were still included in the report card because they impact significant areas of arid Australia and a significant proportion of South Australia. Weeds species are those classified as Weeds of National Significance (WoNS) that occur in South Australia as well as buffel grass. Note that wild dogs were not included in analyses in the Alinytjara Wilurara (AW) NRM Region, or north of the dog fence in the SA Arid Lands (SAAL) NRM Region.

Table 2.1. Key invasive species that are addressed in the report

Common names	Species name
African boxthorn	<i>Lycium ferocissimum</i>
Asparagus Weeds	Weeds in Genus Asparagus
Athel Pine	<i>Tamarix aphylla</i>
European Blackberry	<i>Rubus fruticosus ssp.</i>
Boneseed	<i>Chrysanthemoides monilifera</i>
Bridal Creeper	<i>Asparagus asparagoides</i>
Brooms	(<i>Cytisus scoparius</i> , <i>Genista linifolia</i> , <i>G. monspessulana</i>)
Buffel grass	<i>Cenchrus pennisetiformis</i> , <i>Cenchrus ciliaris</i>
Chilean needle grass	<i>Nassella neesiana</i>
Gorse	<i>Ulex europaeus</i>
Opuntoid cacti	<i>Austrocyllindropuntia</i> , <i>Cylindropuntia</i> & <i>Opuntia</i> genera, excluding <i>O. ficus-indica</i>
Silverleaf nightshade	<i>Solanum elaeagnifolium</i>
Willows	<i>Salix ssp.</i>
Feral camel	<i>Camelus dromedarius</i>
Feral cat	<i>Felis catus</i>
Feral deer (all species)	<i>Dama ssp.</i>
Feral goat	<i>Capra aegagrus hircus</i>
Feral pig	<i>Sus scrofa</i>
Feral rabbit	<i>Oryctolagus cuniculus</i>
Fox	<i>Vulpes vulpes</i>
Mice	<i>Mus musculus</i>

Starling

Sturnus vulgaris

Wild dog

Canis lupus (all subspecies and hybrids – excluding AW NRM Region and north of dog fence in SAAL NRM Region)

2.2 Data sources

The main source of data for this report card is a survey sent to the eight NRM regions. This survey collects qualitative data independently for each NRM region. Surveys were provided to NRM regional staff (typically the person/s in charge of invasive species and compliance) in electronic form on an MS Excel datasheet, which included the regional data provided in previous surveys for reference. The responses to the surveys are often guided by on-ground works in the region, work plans with landholders, field inspections, survey and monitoring. Evidence tends to be ad hoc and therefore has low reliability at the regional or state spatial scale. The survey requires respondents to assign trend and abundance categories for each species, a condition score for the entire NRM region, and to select a method for the data source (e.g. project scale, systematic).

For each of the key invasive species in the region, survey respondents are asked to allocate a trend category for the last five years (2013–17), based on the change in the abundance and distribution:

- Major increase in abundance and or spreading
- Moderate increase in abundance and or spreading
- No change/stable
- Moderate decrease in abundance and or receding
- Major decrease in abundance and or receding
- Effectively eradicated
- Not present
- Unknown.

Regional and state trends of each species are calculated using the median value at the appropriate scale.

The survey also asks respondents to score the current condition (2017) of the NRM region as a whole:

- Very good: Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are not affected by invasive species.
- Good: Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are marginally affected by invasive species.
- Fair: Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are moderately affected by invasive species.
- Poor: Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are significantly affected by invasive species.

The median value of the NRM regional condition scores was calculated for the statewide condition score.

Current distribution (2000–17) was calculated using data from the Biological Databases of South Australia (BDBSA) supertables, which represents the spatial locations of flora and fauna species observations data in BDBSA and the State Herbarium of South Australia (ADHERB). While data can be used to indicate distribution of data, there are major limitations. Data cannot account for annual changes in abundance or distribution. All invasive plant and

animal records, from 2000–17, that were associated with a geographical location (coordinates) were used to determine the distribution of key invasive species in each NRM region. Supertable, including DEW’s data of BDBSA and ADHERB is updated weekly, but some external projects data can be delayed based on resources and requirements.

2.3 Trend

For the purpose of calculating trends, species scores were assigned values (2 = Major increase in abundance and or spreading, 1 = Moderate increase in abundance and or spreading, 0 = Stable, -1 = Moderate decrease in abundance and or receding, -2 = Major increase in abundance and or receding, unknown and not present values were excluded from analyses).

NRM regional trends were calculated by finding the median value of the species scores within each region (see Figure 1 for NRM regional boundaries). State trend was calculating by intergrating species scores across all NRM regions. Note that there were 2 exceptions to this (deer and buffel grass) where state trend was calculated by weighting the regional scores based on the distribution of the invasive species in each region.

Trend for species, state and NRM regions were classed as getter better if median score was -0.5 or below, stable if average was 0.49 to -0.49, and getting worse if average was 0.5 or above.

Trend for species at state level and for NRM regions were classed as unknown if more than half of the records were unknown.

Table 2.2. Definition of trend classes used

Trend	Description	Threshold
Getting better	Over a scale relevant to tracking change in the indicator it is improving in status with good confidence	Median score = -0.5 or less
Stable	Over a scale relevant to tracking change in the indicator it is neither improving or declining in status	Median score is 0.0
Getting worse	Over a scale relevant to tracking change in the indicator it is declining in status with good confidence	Median score = 0.5 or more
Unknown	Data are not available, or are not available at relevant temporal scales, to determine any trend in the status of this resource	More than half records in calculation are unknown
Not applicable	This indicator of the natural resource does not lend itself to being classified into one of the above trend classes	

2.4 Condition

Condition score is a single state-level statement of condition for 2017 that has been derived from the *Natural Resources Management Act 2004* and related to invasive terrestrial species (Table 2.2). For this assessment, condition has been scored at NRM regional scale by Biosecurity SA and DEW staff who work in the area of pest and weed control.

Table 2.3. Definition of condition classes used

Condition	Description	Threshold
Very good	Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are not affected by invasive species.	N/A
Good	Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are marginally affected by invasive species.	N/A
Fair	Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are moderately affected by invasive species.	N/A
Poor	Natural resources and our environmental, social and economic expectations of these (e.g. primary productivity) are significantly affected by invasive species.	N/A
Unknown	Data are not available to determine the impact of invasive species on our natural resources	-
Not applicable	Invasive species impact does not lend itself to being classified into one of the above condition classes	-

2.5 Limitations

Models to estimate abundance or distribution over time (trend) is currently being developed.

2.6 Reliability

Information is scored for reliability based on the average of subjective scores (1 [worst] to 5 [best]) given for information currency, applicability, level of spatial representation and accuracy. Definitions guiding the application of these scores are provided in Tables 2.4, 2.5, 2.6 and 2.7, respectively.

Table 2.4. Guides for applying information currency

Currency score	Criteria
1	Most recent information >10 years old
2	Most recent information up to 10 years old
3	Most recent information up to 7 years old
4	Most recent information up to 5 years old
5	Most recent information up to 3 years old

Table 2.5. Guides for applying information applicability

Applicability score	Criteria
1	Data are based on expert opinion of the measure
2	All data based on indirect indicators of the measure
3	Most data based on indirect indicators of the measure
4	Most data based on direct indicators of the measure
5	All data based on direct indicators of the measure

Table 2.6. Guides for applying spatial representation of information (sampling design)

Spatial score	Criteria
1	From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown
2	From an area that represents less than 25% the spatial distribution of the asset within the region/state
3	From an area that represents less than half the spatial distribution of the asset within the region/state
4	From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified
5	From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design

Table 2.7. Guides for applying spatial representation of information (sampling design)

Accuracy score	Criteria
1	Better than random
2	> 60% better than random
3	> 70 % better than random
4	> 80 % better than random
5	> 90 % better than random

3 Results

3.1 Reliability

The overall reliability score for this report card is 2, based on Table 3.1

Table 3.1 Information reliability scores for numbers of incursions of diseases and invasive species

Indicator	Applicability	Currency	Spatial	Accuracy	Reliability
Invasive species data	3	1	1	1	1.5
Overall	-	-	-	-	1

3.2 Whole-of-state

At the state level, trends in distribution and abundance of weeds of national significance and key vertebrate pests between 2013–17 were getting worse (map right).

Of the weeds of national significance and key vertebrate pests that were assessed, 40 per cent were getting worse, 9 per cent were getting better, 17 per cent were unknown and 35 per cent were stable. Feral goats, deer and pigs, wild dogs, mice, buffel grass, brooms, bridal creeper and other asparagus weeds were getting worse in abundance and/or distribution. Feral rabbits and gorse were getting better. Foxes, African boxthorn, opuntoid cacti, Athel pines, boneseed, blackberry, silverleaf nightshade and willows had a stable trend at the state scale.

The current condition have been classed as poor. Invasive species currently have profound impacts on primary industries, natural environments and our society. For example, rabbits have the ability to halt vegetative growth, wild dogs kill livestock, invasive herbivores reduce pastures and crops. The degree of impact varies depending on the species, environment and land use.

Unfortunately many invasive species are widespread in South Australia. Management and good policy help to limit their impacts and prevent new introductions, but many species can not be eradicated from our landscape.

Note that distribution per cent in table 3.2 may be an underestimate because of data limitations.

Table 3.2 State scores for key invasive species

Established weeds and pests	Distribution (%) of State	Trend between 2013–17
African boxthorn	5.96	Stable
Asparagus weeds	5.89	Getting worse
Athel pine	2.19	Stable
European Blackberry	1.55	Stable
Boneseed	1.60	Stable
Bridal creeper	-	Getting worse
Brooms	0.96	Getting worse
Buffel grass	5.23	Getting worse

Chilean needle grass	0.09	Unknown
Gorse	1.03	Getting better
Opuntoid cacti	2.59	Stable
Silverleaf nightshade	1.25	Stable
Willows	0.46	Stable
Feral cat	99.94	Unknown
Feral rabbit	99.53	Getting better
Feral fox	99.52	Stable
Feral camel	69.44	Unknown
Wild dog	82.94	Getting worse
Feral goat	33.26	Getting worse
Starling	19.57	Unknown
Feral pig	8.78	Getting worse
Feral deer (all species)	2.80	Getting worse
Mice	6.83	Getting worse
Statewide trend		Getting worse
Statewide condition		Poor

3.3 Natural resources management regions

Results from survey of experts from NRM region are summarised in Table 3.3 and 3.4.

Trends are based on those key weeds of national significance and vertebrate pests. Condition is based on their current impact – note that many species have a much higher potential impact but good policy and management prevent impacts from increasing.

Table 3.3 2017 condition and trend score for each NRM region – scored by NRM regional experts

	Recent trends (2013–17)	Current condition (2017)
Adelaide and Mount Lofty Ranges Natural Resources Management Region	Getting worse	Poor
Alinytjara Wilurara Natural Resources Management Region	Stable	Fair
Eyre Peninsula Natural Resources Management Region	Stable	Fair
Kangaroo Island Natural Resources Management Region	Stable	Fair*
Northern and Yorke Natural Resources Management Region	Getting worse	Poor

	Recent trends (2013–17)	Current condition (2017)
SA Arid Lands Natural Resources Management Region	Stable	Poor
SA Murray-Darling Basin Natural Resources Management Region	Stable	Poor
South East Natural Resources Management Region	Getting worse	Poor

*Condition of vertebrate pests is good on Kangaroo Island, with all invasive herbivores not present. Condition of weeds is fair with significant stands of African boxthorn and asparagus weeds.

Table 3.4 Qualitative results of surveys: trend of invasive species in each NRM region for the five year period from 2013–17

Established weeds and pests	AMLR 5yrTrend	AW 5yrTrend	EP 5yrTrend	KI 5yrTrend	NY 5yrTrend	SAAL 5yrTrend	SAMDB 5yrTrend	SE 5yrTrend
African boxthorn	Unknown	0	-1	1	1	0	1	-1
Asparagus weeds	1	Not present	0	1	1	Not present	0	1
Athel pine	0	0	0	0	0	0	0	Unknown
Boneseed	1	Not present	1	Not present	-1	-2	-1	1
European Blackberry	0	Not present	0	-2	-1	Not present	1	2
Bridal creeper	1	Not present	1	1	1	Not present	0	0
Brooms	Unknown	Not present	Effectively eradicated	-2	0	Not present	1	1
Buffel grass	-1	1	1	Not present	-1	1	-2	Effectively eradicated
Chilean needle grass	0	Unknown	Unknown	Not present	Not present	Not present	Not present	Unknown
Gorse	0	Not present	-1	-1	-1	Not present	0	-2
Opuntoid cacti	1	0	0	Not present	1	0	-1	Unknown
Silverleaf nightshade	1	0	0	Effectively eradicated	1	Unknown	0	0
Willows	1	Not present	Unknown	Not present	0	Not present	0	Unknown
Feral cat	Unknown	0	0	Unknown	Unknown	1	0	Unknown
Wild rabbit	0	-1	-1	Not present	0	Unknown	-1	0
Feral fox	0	0	0	Not present	0	Unknown	0	0
Feral camel	Not present	0	Unknown	Not present	Not present	0	Unknown	Not present
Wild dog	1	Not present	0	Not present	1	Unknown	1	1
Feral goat	0	Not present	0	Effectively eradicated	1	1	1	1
Starling	Unknown	0	0	0	0	Unknown	Unknown	Unknown

Feral pig	2	Not present	Not present	1	1	1	-1	1
Feral deer (all species)	1	1	0	Effectively eradicated	1	0	1	1
Mice	1	0	0	0	1	Unknown	1	1

Number indicates trend:

2 = Major increase in abundance and or spreading, 1 = Moderate increase in abundance and or spreading, 0 = Stable, -1 = Moderate decrease in abundance and or receding, -2 = Major increase in abundance and or receding

Distribution of each species were based on records in the state's biological database between 2000–17 are described in Table 3.5. Distribution data are indicative only. The dataset is not complete and do not take recent control efforts into account.

Table 3.5 Distribution of invasive species as a percentage of each NRM region based on BDBSA supertable records from 2000–17

Established weeds and pests	Distribution as a percentage of each terrestrial NRM region (2000–17)							
	% AMLR	% AW	% EP	% KI	% NY	% SAAL	% SAMDB	% SE
African boxthorn	73.92	0.13	8.14	16.71	53.92	0.93	31.95	27.02
Asparagus weeds	83.15	0.00	20.04	56.23	28.66	0.00	28.94	50.77
Athel pine	4.78	0.29	0.06	7.86	1.51	3.38	2.93	1.12
European Blackberry	59.04	0.00	2.11	20.96	3.25	0.00	3.40	23.56
Boneseed	49.09	0.00	6.37	0.00	0.72	0.02	7.78	16.88
Brooms	52.43	0.00	0.19	2.28	3.41	0.00	2.73	11.51
Buffel grass	15.97	3.85	3.93	0.00	9.27	5.97	5.21	0.75
Chilean needle grass	13.11	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Gorse	56.13	0.00	0.39	11.15	3.51	0.00	3.05	10.40
Opuntoid cacti	54.07	0.12	1.32	0.85	11.59	1.34	17.34	0.75
Silverleaf nightshade	47.70	0.06	1.81	3.48	4.94	0.02	7.03	8.19
Willows	26.88	0.00	0.00	0.00	0.58	0.00	2.08	5.32
Feral cat	99.72	100.00	99.46	99.19	99.78	100.00	99.69	99.89
Wild rabbit	100.00	100.00	99.62	0.38	99.91	100.00	100.00	99.94
Feral fox	100.00	100.00	99.53	0.38	99.92	100.00	99.99	99.94
Feral camel	0.00	100.00	20.90	0.00	0.83	74.60	0.95	0.00
Wild dog*	3.02	0.41	19.22	0.00	32.47	37.06*	2.28	1.23
Feral goat	99.56	1.12*	51.85*	96.16	78.69	35.47	99.71	69.31
Starling	100.00	1.45	78.88	86.16	94.48	7.15	76.35	92.84
Feral pig	42.46	0.12	1.00	79.94	0.01	12.79	17.15	0.00
Feral deer (all species)	26.82	0.00	1.27	33.00	2.32	0.08	3.48	76.50
Mice	44.25	4.25	20.35	31.79	13.21	4.21	20.40	9.24

*Proportion of wild dogs is calculated within the dog fence only. Outside the dog fence, wild dogs are considered to be dingoes and are not a declared invasive species.

4 Discussion

4.1 Trend

Between 2013–17, there was trend in the overall distribution and abundance of invasive species across our state was getting worse, based on ad hoc evidence from each natural resources management region.

Control of invasive species is generally more resourced than monitoring. Therefore much of the data collected about invasive species is from on ground reporting. At times there are dedicated monitoring efforts, although these tend to be limited to local scale in line with specific project outcomes. Most records of invasive species are captured in an ad-hoc manner, for example, reported as a result of management actions by land managers in particular areas, detections by public, or recorded during field surveys that target other species (e.g. Malleefowl surveys). These records allow for distribution mapping over a long period, but are not reliable to assess annual changes in a species abundance or distribution across its entire range. Therefore regional information may not represent the region as a whole – rather specific target areas.

In the Eyre Peninsula (EP) NRM region in 2017 there were systematic surveys of buffel grass and mice. Buffel grass had an increasing distribution and mice were stable between 2013–17. Other invasive species were captured through ad hoc surveys. There was a moderate decrease in abundance and/or receding spread of African boxthorn in that NRM region. An intensive aerial control program along the state's west coast has reduced the regional population. The remaining population is stable or has a moderate increase. Bridal creeper has a stable, widespread population in southern Eyre Peninsula where rainfall is higher. Biological control (rust) has spread across some of the area but with no significant impact as yet. Mice, fox and cat populations fluctuate between seasons, depending on food availability.

In the Alinytjara Wilurara (AW) NRM region there is considerable effort spent to monitor and manage buffel grass. Buffel grass is considered a major threat due to its ability to transform a structurally complex and diverse vegetation associations into monocultures (Bastin *et al.* 2008). Most tracks and roads within southern AW are monitored in association with control actions for this species. Monitoring and treatment tend to be relatively methodical and are undertaken after rains, and along tracks that are known to be vectors (east–west rail line for example). The region also has a buffel-free GVD initiative which is gaining some ground, and within APY areas are treated with cultural/ecological significance for buffel. Buffel is generally on the increase within AW. There have been systematic surveys of athel pine in recent years, which has a stable population/distribution in the region. Many of the pest animal species are recorded in threatened species surveys, for example cats and fox numbers are heavily monitored in the APY lands in relation to the Warru recovery project. Camels are heavily monitored and culled at times when abundance is particularly high.

In the South Australian Arid Lands (SAAL) NRM region feral pigs are the only species that were systematically surveyed in 2017. Annual aerial control in the Channel Country has seen numbers suppressed in this district, coinciding with an increase in control effort in the Desert Channels region of Queensland. However, a survey conducted in the North East Pastoral District of SA around the Barrier Highway has indicated a moderate increase in numbers in this district. Information is gathered in the region regarding wild dogs that are sighted and destroyed on properties, but the information is anecdotal and the collection method is ad hoc, with limited baseline data on the population of wild dogs (south of the fence) before control measures were implemented.

There have been limited weed surveys in the SAAL region. There are extensive infestations of buffel grass and opuntoid cacti that require significant resources to control. A major obstacle to controlling buffel grass is the value pastoralists place on it as stock feed. This attitude needs to change before effective control can occur on these properties. Engaging with appropriate land managers and railway owners is essential to stopping the spread of invasive species in the region.

NRM boards, Department for Environment and Water and Biosecurity SA oversee programs to destroy or contain invasive species and prevent new ones from establishing in SA.

In the Northern and Yorke (NY) NRM region there are no species that were systematically surveyed in 2017, however most of the invasive species addressed in this report are monitored at site or local scale.

In the Adelaide and Mount Lofty Ranges (AMLR) NRM region in 2017, there were systematic surveys of bridal creeper, buffel grass and Chilean needle grass, and small-scale surveys of feral goats, pigs and deer. Buffel grass populations are all under management. Surveys of goats at Montacute, Cherryville, Morialta, Blackhill and Kangaroo Creek suggest that ground shooting and trapping has not been effective in reducing abundance of goats.

In the Kangaroo Island (KI) NRM region in 2017, there were systematic surveys of African boxthorn, blackberry, broom, gorse and outliers of asparagus weeds, as well as ad hoc surveys of athel pine and former sites of boneseed and silverleaf nightshade. Feral cats and pigs have been surveyed in target areas and there has been on-going monitoring of the known habitat of feral goats and deer. Between 2013–17 there were increases in abundance and/or spreading of African boxthorn and asparagus weeds – both have high abundance in eastern Kangaroo Island but low on the western side of the island, although African boxthorn is spreading in north west Kangaroo Island. *Asparagus declinatus* is spreading towards the north and west and becoming increasingly dense across the core area. Between 2013–17 there were decreases in blackberry, broom and gorse. All known populations are under control. Silverleaf nightshade, feral goats and deer are effectively eradicated on the island.

In the South Australian Murray-Darling Basin (SAMDB) NRM region in 2017, there were systematic surveys of many invasive species in line with regional and national plans. These surveys are often at a local scale and include African boxthorn, blackberry, goats and deer (increasing), boneseed, buffel grass, opuntoid cacti (decreasing) and athel pine, gorse, willows and cats (stable).

In the South East (SE) NRM region there were systematic surveys in 2017 of African boxthorn, asparagus weeds, brooms, opuntoid cacti, and silverleaf nightshade. Gorse and boneseed surveys are underway. Feral deer and a significant pest and in the last round of aerial shooting, nearly 2000 deer were killed.

4.2 Condition

Overall the condition of invasive species has been assessed as poor because they have profound impacts on our primary industries, natural resources and way of life.

A study by McLeod (2016) on the economic impact of pest animals estimates that feral rabbits, goats, pigs, foxes, wild dogs, introduced birds and carp cost Australia between \$416 (at low densities) and \$797 million (at high density scenarios) annually in production losses and expenditures on management at the farm and government levels. Key losses include reduced wool and meat production as a result of grazing competition with rabbits and goats, predation by wild dogs, foxes and feral pigs, crop damage by feral pigs and introduced bird damage on viticulture. The impact of natural systems, biodiversity and tourism industry has not been quantified but expected to be a similar amount.

The focus of biosecurity in South Australia is to reduce impact in the most effective manner guided by SA [Weed](#) and [Pest](#) Animal Risk Management guides. Control methods include coordinated shooting or removal of pest animals, chemical treatment of weeds, or development of policies in line with current threats and opportunities. But the most effective way to manage weeds and vertebrate pests is to prevent new species becoming established.

4.3 Future reporting

Future reporting needs to develop methodology to systematically assess the impacts that invasive species are have as well as trends in abundance and distribution.

A method that is currently being assessed for suitability is one that looks at all plant and animal data are recorded each year and the proportion of these records that are invasive species. These results are a proxy for annual distribution.

In that method, records were sorted into 10x10 km grid squares (polygons). Polygons with more than 20 records of any taxa were included for analyses (polygons with 20 or less were excluded). Each polygon was associated to a sampling year and its NRM region for analysis.

Not all years or NRM regions had enough data to form trends. Only years with more than five polygons (per NRM region) with sufficient data were included in analyses of condition and trend. The number of polygons that contained records of the invasive species in question were calculated relative to the total number of polygons with 20 records of any taxa per NRM per year.

Trends could then be determined looking at change over time, confidence testing and estimating data reliability. The following graphs are examples of the results when the methods were applied to two key terrestrial pest animals.

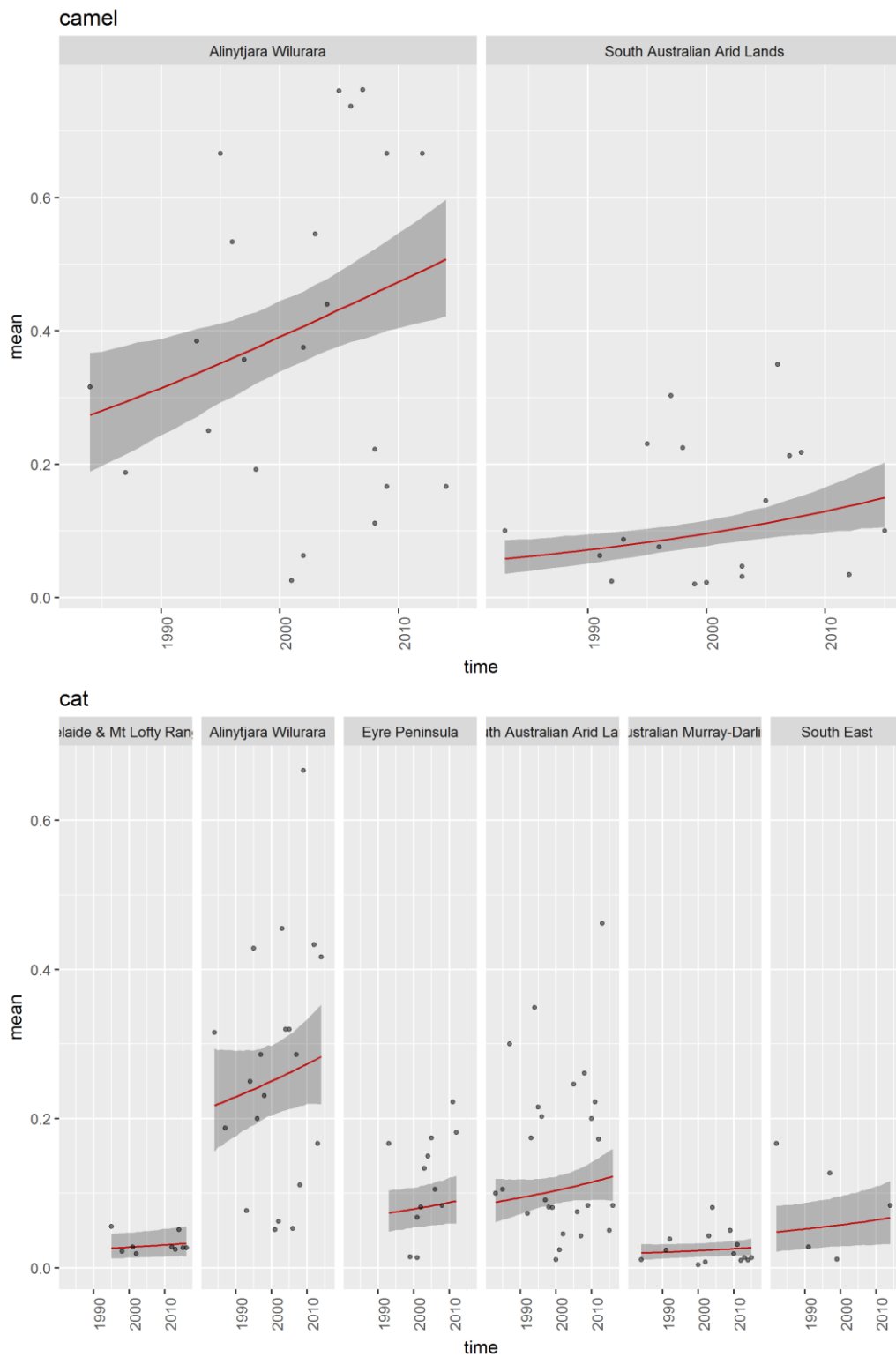


Figure 4.1 Trends over time of the per cent of surveys that observed invasive vertebrates. These graphics have not been fully developed, results need to be reviewed before calculations are used for invasive species assessment.

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