



# Kangaroo Island Feral Pig Survey Economic Analysis

Final Report

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Prepared by Stuart Peavor, EIB Consulting for the  
Commissioner for Kangaroo Island



## Disclaimer and Acknowledgments

Some information contained in this report has been prepared from discussions with third party sources. While care has been taken to establish the accuracy of this information, some assumptions and conclusions drawn by these information sources will remain as the views of the parties that formed them.

The author wishes to acknowledge the generous assistance of officers from relevant organisations that provided input into this study and acknowledges that the views expressed by these officers may not necessarily reflect those held by their organisations.

The author also wishes to acknowledge the generous assistance of survey participants who offered further time for survey follow-up.

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## Executive Summary

This report presents the findings of an independent analysis of a recent survey of primary production landholders on Kangaroo Island (Island), developed to better understand the economic impacts caused by feral pigs on the Island. The results suggest that even small numbers of feral pigs can cause significant damage to landowners' properties. This is significant given the area impacted is some of the most productive land on the Island.

Based on survey respondent observations, the population of pigs appears to have remained relatively consistent over recent years. However, the survey results also indicate that the economic impact of feral pig activity is increasing.

The damage caused by feral pigs has increased substantially between 2015 and 2017. In 2017, 81 per cent of respondents reported impacts from feral pigs. This compares to 2015 where 61 per cent of respondents reported impacts from feral pigs.

Of all the damage or losses incurred between 2015 and 2017, damage or losses to fencing experienced the greatest increase, with a 90 per cent increase over this period.

The management response to these impacts has also increased substantially. Between 2015 and 2017, a total of 6,418 hours were reported as spent controlling feral pigs. This represents an increase of over 150 per cent over this period. Around half of these hours were spent in 2017. Shooting has been the most significant controlling method by time invested, making up 45 per cent of the total hours spent controlling feral pigs.

There are economic impacts from this damage, and the associated management response. While economic impacts were not quantified by survey respondents, estimates have been derived using local specialist advice, survey respondent follow-up, and other third-party sources. Impacts have also been estimated for the wider landowner population.

The total economic impact of the damage and management responses reported is estimated to be \$1.16 million over the three-year period. This includes an economic impact of \$0.56 million in 2017 – an increase of 111 per cent from 2015. The largest economic impact was damage to pasture; estimated to be half the economic cost over the three-year period.

Extrapolating these results to the wider population of surveyed landowners, suggests a total economic impact of \$1.65 million between 2015 and 2017, with around half this impact in 2017.

These estimates have been provided using the best information available at this time. However, to further refine these estimates, further follow-up with survey non-respondents is suggested as

well as further research of costs which may be underestimated (such as the costs of hunting and dogs in response to feral pigs).

Furthermore, there are some costs that have not been able to be quantified in this report. For example, potential lost production (opportunity cost) from reduced stock capacity and loss of grain production due to land degradation has not been estimated, as this information was not collected as part of the survey. Further research of these costs would assist to provide a comprehensive picture of the total economic impacts of feral pigs on the Island.

## 1. Scope of the project

The project was undertaken to provide independent analysis of a recent survey of primary production landholders on Kangaroo Island (Island), developed to better understand the economic impacts caused by feral pigs (*Sus scrofa*) on the Island. This report summarises the findings of that project.

## 2. Methodology

The following is a summary of the project methodology:

- Stage 1: An understanding of the background and contextual aspects of the survey was sought to allow for meaningful analysis. This included seeking information on the sampling methodology, characteristics of the target population, and other necessary background information to aid analysis of the survey results.
- Stage 2: Analysis was conducted on the survey results to determine impacts of feral pigs on the Island. As part of this analysis, it was necessary to draw on information from external sources including government agencies, published literature, and follow-up phone calls with survey respondents. Additional information collected included:
  - fencing, trapping, hunting and shooting costs
  - volunteer labour cost estimates
  - pasture rehabilitation costs
  - revegetation costs, and
  - clarification of survey question responses from survey respondents.

## 3. The area and animals in scope of the project

### 3.1.1. Kangaroo Island

Kangaroo Island is 112 km south-west of Adelaide and is total of 440,073 hectares (ABS, 2018). The main employing industry on the Island is primary production (agriculture, forestry and fishing), with around 40 per cent of all Island businesses in this category in 2015 (ABS, 2018). The area in scope of the survey is some of the most productive land on the Island.<sup>1</sup>

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<sup>1</sup> PIRSA, pers. comm., 17 April 2018.

### 3.1.2. Feral pigs

Feral pigs are found mostly on the western end of the Island and often in inaccessible areas (Department of Environment and Water (DEW), 2017). An accurate estimate of the number of feral pigs currently inhabiting the Island was not able to be obtained from a desktop study, or from discussions with DEW representatives, for this study. However, this was not critical to the analysis.

## 4. Overview of the survey

The survey was delivered online, and included questions relating to feral pig prevalence, impact and management, over the three financial years between 2015 and 2017.

The survey was sent to 240 owners of land that could be used for primary production, located within an area known to be inhabited by feral pigs.<sup>2</sup> A total of 40 landowners responded to the survey, representing a response rate of 17 per cent.

The results exclude feral pig impacts on non-primary production landowners (for example, public land and national parks are excluded).<sup>3</sup>

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<sup>2</sup> The total inhabited area was determined by local DEW officers. This included approximately 25,400 hectares of forestry land owned by Kangaroo Island Plantation Timbers (KIPT). KIPT were one of the 40 who responded to the survey.

<sup>3</sup> While the survey was not sent to non-primary production landowners, some respondents reported impacts to native vegetation and revegetation areas which have been included in this study (refer to section 5.2 of this report).

## 5. Survey findings

### 5.1. Feral pig prevalence

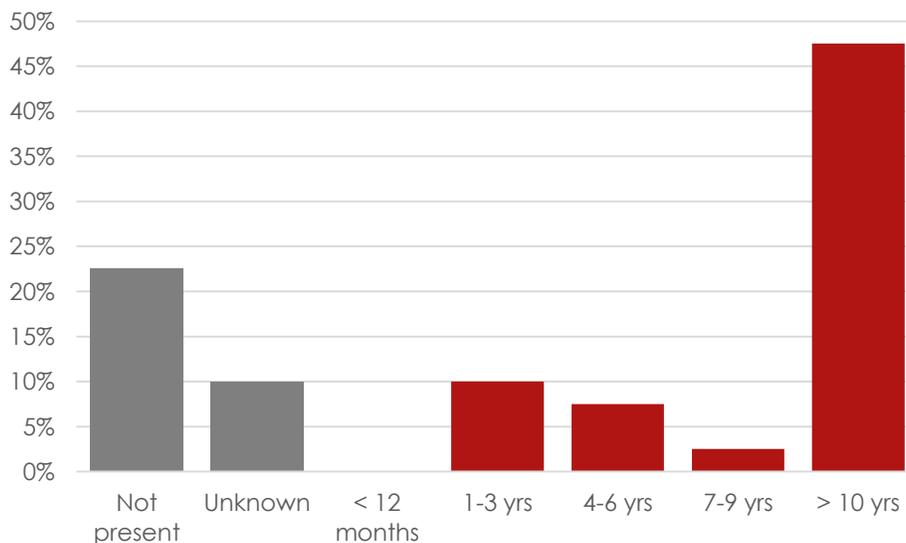
#### Main findings

- Of those surveyed, 23 per cent stated feral pigs were not present on their property in 2017.
- Around 1 in 2 respondents stated feral pigs have been present on their property for over 10 years.
- Between 2012 and 2017, an average of 20 per cent of respondents reported less than 10 pigs lived or moved through their property.
- Over the same period, a further one quarter of survey respondents were unable to estimate how many feral pigs lived, or moved, through their property.
- The survey results suggest the pig population has remained relatively stable over the previous three years in the area, although there are limitations to relying solely on these results.

#### Survey results

The survey asked respondents to report how long feral pigs had been present on their properties, and the months that most damage occurred. Around 1 in 2 respondents stated that feral pigs have been present on their property for over 10 years, with most damage reported from May to September (inclusive). Around one quarter (23 per cent) of all respondents stated that feral pigs were currently not present on their property at the time of the survey (Chart 1).

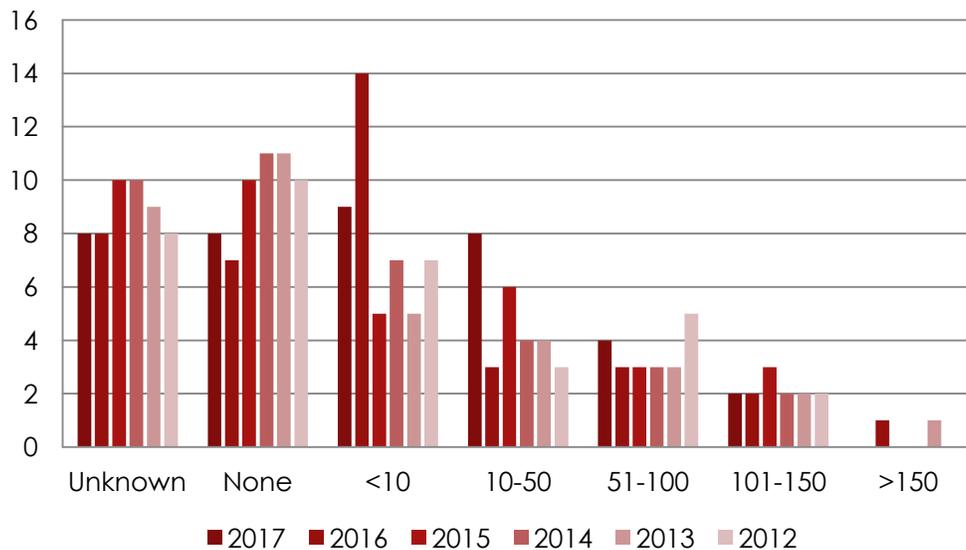
*Chart 1: Length of time feral pigs been present on properties – 2017*



The survey also asked respondents to estimate, on average, how many feral pigs lived or moved through their property over a six-year period from 2012 to 2017.<sup>4</sup> On average, around 20 per cent of respondents reported less than 10 pigs, while a further one quarter were unable to estimate how many feral pigs lived, or moved, through their property (Chart 2).

These results suggest the population of pigs has remained relatively consistent over this period. However, there are limitations to relying solely on these results. Feral pigs are very elusive and are rarely seen during daylight hours. The presence and number of pigs can be more reliably evaluated by observing signs of their activity and impact (NSW Department of Primary Industries, 2017).

*Chart 2: Average number of feral pigs living or moving through properties – 2012 to 2017*



Estimating the population of feral animals at a point in time is difficult. Surveys only provide an indication of the distribution and density of animals within a defined area at a particular point in time, and feral populations can be significantly influenced by climatic conditions (Peevor, 2017, p.14).

That said, landholder surveys provide an indication of the level of damage caused by feral animals, as perceived by landholders (Gentle et. al., 2011, p.5). For the purposes of this report, surveys are considered to be a low cost option to understand the extent and type of damage, when compared with intensive and costly scientific, direct field assessments (Gentle et. al., 2011, p.4).

<sup>4</sup> This was the only question in the survey which covered years prior to 2015.

In any instance, damage can be considerable, even when pig density is relatively low (Gentle et. al., 2011, p.5). Impacts are discussed in the following section.

## 5.2. Feral pig impacts

### Main findings

- In 2017, 81 per cent of respondents reported impacts from feral pigs.
- In the same year, approximately one third of all respondents reported damage or losses to pasture and 17 per cent had fencing damaged.
- There has been a significant increase in reported damage or losses incurred by feral pigs between 2015 and 2017. Those reporting no losses have decreased substantially, from 39 per cent in 2015 to 19 per cent in 2017, representing a halving of non-impacted properties.
- Of all the damage or losses incurred between 2015 and 2017, damage or losses to fencing experienced the greatest increase. There was a 90 per cent increase in damage or losses to fencing over this period.

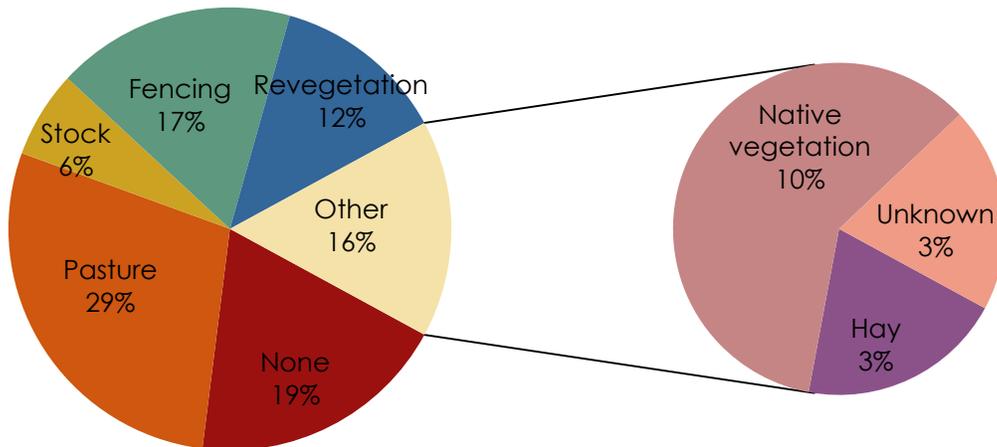
### Survey results

The total cost impact of feral pigs includes direct costs arising from the damage they cause, direct costs from any management response, and other costs (such as environmental damage). The analysis undertaken in this project focused on the direct costs arising from the damage reported by respondents (this section of the report) and their management response to the damage (section 5.3).

The survey asked respondents to report feral pig impacts by types of damage or losses from 2015 to 2017, from a list of closed responses. These responses were determined following discussions with landowners (Office of the Commissioner for Kangaroo Island (OCKI), pers. comm., 2018). The survey question did not separate damage and loss.

In 2017, 81 per cent of respondents reported impacts from feral pigs. In the same year, approximately one third of all respondents reported damage or losses to pasture, and 17 per cent had fencing damaged. A total of 16 per cent of respondents reported some 'other' impact. This included 10 per cent from impacts relating to native vegetation, and 3 per cent relating to hay (Chart 3).

Chart 3: Damage and loss caused by feral pigs on properties – 2017



There has been a significant increase in reported damage or losses incurred by feral pigs between 2015 and 2017 (Charts 3 to 5). Those reporting no losses have decreased substantially from 39 per cent in 2015 to 19 per cent in 2017, representing a halving of non-impacted properties.

Of all the reported damage or losses incurred between 2015 and 2017, fencing and vegetation experienced the greatest increase. There was a doubling of impacts and losses to native vegetation (from 5 per cent to 10 per cent) over this period, which was reported within the 'other' category. There was also a 90 per cent increase in damage or losses to fencing over the same period (Charts 3 to 5).

Chart 4: Damage and loss caused by feral pigs on properties – 2016

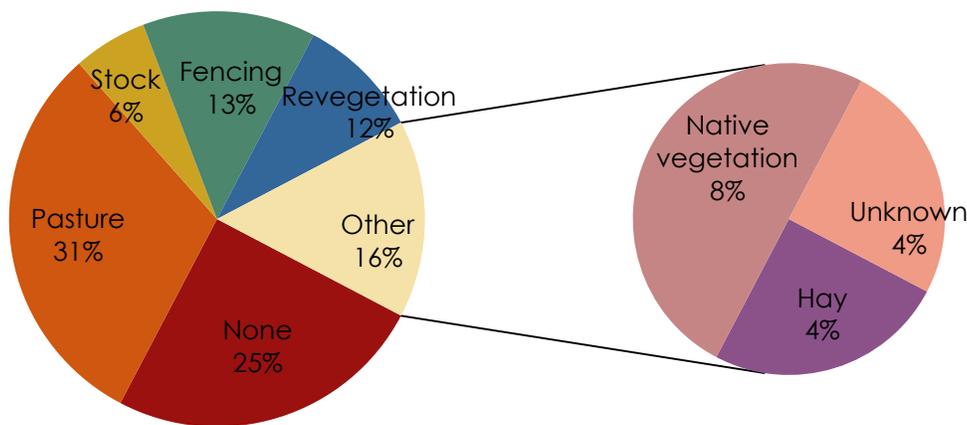
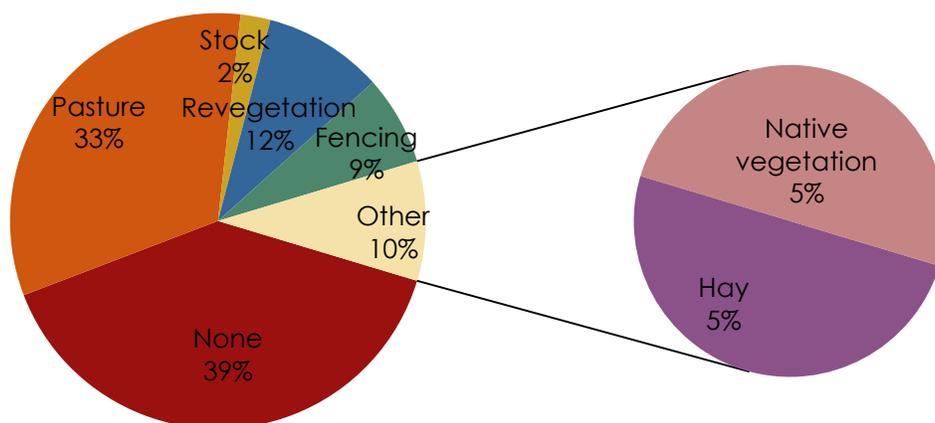


Chart 5: Damage and loss caused by feral pigs on properties – 2015



The survey also asked respondents to report the total area of crops, total length of fencing, and total stock on their property – allowing for 'rates of damage/loss' to be calculated for the 2015 to 2017 period.

Table 1: Rates of damage/loss by type – 2015-17<sup>5</sup>

Impact	Percentage Affected		
	2017	2016	2015
Pasture (Ha)	8.9	9.7	8.9
Stock (Head)	1.0	0.8	1.8
Fencing (metres)	2.4	3.8	7.3
Revegetation (Ha)	5.5	1.2	NA <sup>6</sup>

### Further insights

Phone follow-up was undertaken to understand the nature of some of the types of damage/loss reported in the survey. Some of the insights obtained included:

- Damage to revegetation included damage from digging up the soil surface and digging up trees and tree roots.
- Damage to pasture included damage from digging up the paddock surface.

<sup>5</sup> The low number of responses reported for hay, native vegetation, and other crops have been excluded from this particular analysis.

<sup>6</sup> Not applicable (NA): Total area of revegetation reported in 2015 is too small to provide a meaningful response.

- Both damage to revegetation and to pasture resulted in erosion.
- Undulating and disturbed pasture has led to loss of stock;<sup>7</sup> as a result, stock can get stuck in muddy soil.
- Feral pigs have also preyed on young lambs, and caused damage to pasture that has resulted in the loss of young lambs.

### 5.3. Management responses to feral pigs

#### Main findings

- Over the 2015-17 period, a total of 6,418 hours were reported as spent controlling feral pigs. This represents an increase of over 150 per cent over this period. Around half of these hours were spent in 2017.
- Shooting has been the most significant controlling method by time invested, making up 45 per cent of the total hours spent controlling feral pigs.
- From 2015 to 2017, there has been a fivefold increase in hours spent trapping, the highest of all controlling methods.
- Shooting has been responsible for removing the most feral pigs from properties over the three-year period.
- In 2017, two thirds of all hours spent removing feral animals were by the landowner or their employees.
- There has been a reduced reliance on volunteers, in a relative sense, although total volunteer hours controlling feral pigs have still increased over the period (by 90 per cent).

#### Survey results

The survey asked respondents to report the number of hours spent controlling feral pigs and the total feral pigs removed from their property, by controlling method, from 2015 to 2017. A list of methods was provided to survey respondents; this list was determined following discussions with landowners (OCKI, pers. comm. 2018).

It is important to understand that management response to feral animals may underestimate the damage that they cause, as damage may often fall below a 'threshold value' for which control action is not justified on a cost/benefit assessment. For example, if feral pigs were to cause \$600 damage to a property, and the costs of a management response to that damage was estimated at \$1,000, it would, ordinarily, not be expected that a management response would be enacted. It is, therefore, important when measuring the true impact of feral animals, to

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<sup>7</sup> Two respondents reported losing stock annually as a result of damage to pasture caused by feral pigs.

include both measures of direct damage and management response – as was done in the survey.

Over the three years, a total of 6,418 hours was reported as spent controlling feral pigs (Table 3), with around half the hours (47 per cent) spent in 2017 (Table 3). This represents an increase of over 150 per cent from 2015.

*Table 2: Total hours spent controlling feral pigs – 2015 to 2017*

Year	Total hours
2017	3,043
2016	2,188
2015	1,187
<b>TOTAL</b>	<b>6,418</b>

Shooting has been the most significant controlling method by time invested, making up 45 per cent of the total hours spent controlling feral pigs (Table 3). Across the period, hours spent trapping has increased the most; increasing fivefold between 2015 and 2017. Hours spent shooting has trebled over the same period, and the increase in hours for dogs and exclusion fencing have also increased significantly, by 57 and 56 per cent respectively.

*Table 3: Total hours spent controlling feral pigs – 2015-17<sup>8</sup>*

Method	2017	2016	2015	TOTAL	% of TOTAL
Trapping	623	313	120	1,056	16.5
Shooting	1,550	854	512	2,916	45.4
Dogs	683	570	435	1,688	26.3
Exclusion fencing	187	451	120	758	11.8
<b>TOTAL</b>	<b>3,043</b>	<b>2,188</b>	<b>1,187</b>	<b>6,418</b>	<b>100.0</b>

<sup>8</sup> Due to the low number of responses reported for hay, native vegetation, and other crops, these categories have been excluded from this particular analysis.

Of all the controlling methods, shooting has been responsible for removing more feral pigs from properties over the three-year period, with a total of 805 feral pigs removed using this method. This is over 80 per cent more than either trapping or dogs (Table 4). However, trapping has been the most effective method by hour invested, removing 0.41 feral pigs per hour (Table 4) over the three-year period, although this figure varies significantly between years (refer to Charts 7 to 9).

*Table 4: Total feral pigs removed– 2015-17*

Method	Total pigs removed	No. feral pigs/hr invested
Trapping	436	0.41
Shooting	805	0.28
Dogs	447	0.26
Exclusion fencing <sup>9</sup>	13	0.02

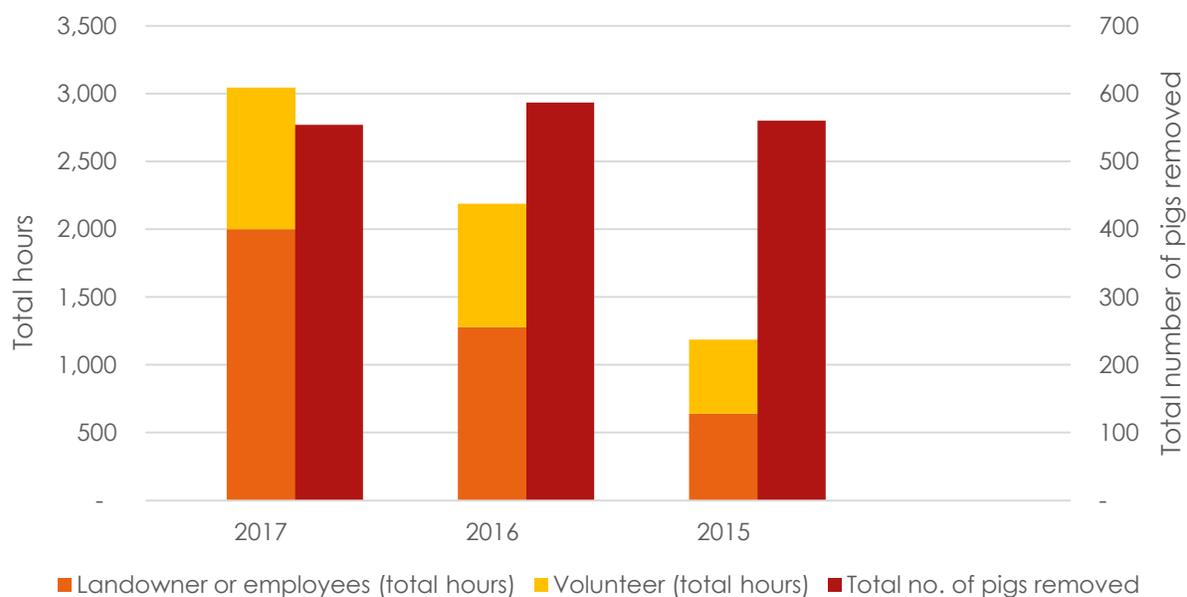
The survey also recorded whether the hours controlling feral pigs were incurred by the respondent or their employees, or by a volunteer. Hours controlling feral pigs have increased for landowners and their employees (over 200 per cent), and volunteers (90 per cent) over the period. However, the results indicate that landowners and their employees have contributed the most effort over the period, with a reduced reliance on volunteers in a relative sense. In 2017, two thirds (66 per cent) of all hours incurred removing feral animals were spent by the landowner or their employees. This has steadily risen since 2015 (Table 5 and Chart 6).

*Table 5: Total feral pigs removed– 2015 to 2017*

Year	Hours by landowner or employee (Percentage of total)	Hours by Volunteer (Percentage of total)
2017	66	34
2016	58	42
2015	54	46

<sup>9</sup> It is difficult for respondents to measure the number of feral pigs 'removed' as a result of exclusion fencing. Care should therefore be taken when interpreting this controlling method.

Chart 6: Total hours spent controlling feral pigs and feral pigs removed, by person, all methods – 2015 to 2017<sup>10</sup>



The results also indicate that reliance on volunteers has been the greatest, in both an absolute (1,277 hours) and relative (76 per cent) sense, in the use of dogs as a form of control, over the three-year period. Conversely, respondents have reported only a very small (3 per cent) input from volunteers for exclusion fencing (Table 6 and Charts 7 to 9).

Table 6: Use of volunteers for feral pig control, select controlling methods – 2015-17

Method	Total volunteer hours	As a percentage of total hours of that method
Trapping	40	4
Shooting	1,162	40
Dogs	1,277	76
Exclusion fencing	20	3

<sup>10</sup> No respondent reported exclusion fencing for this year.

Chart 7: Total hours spent controlling feral pigs and feral pigs removed, by person and method – 2017

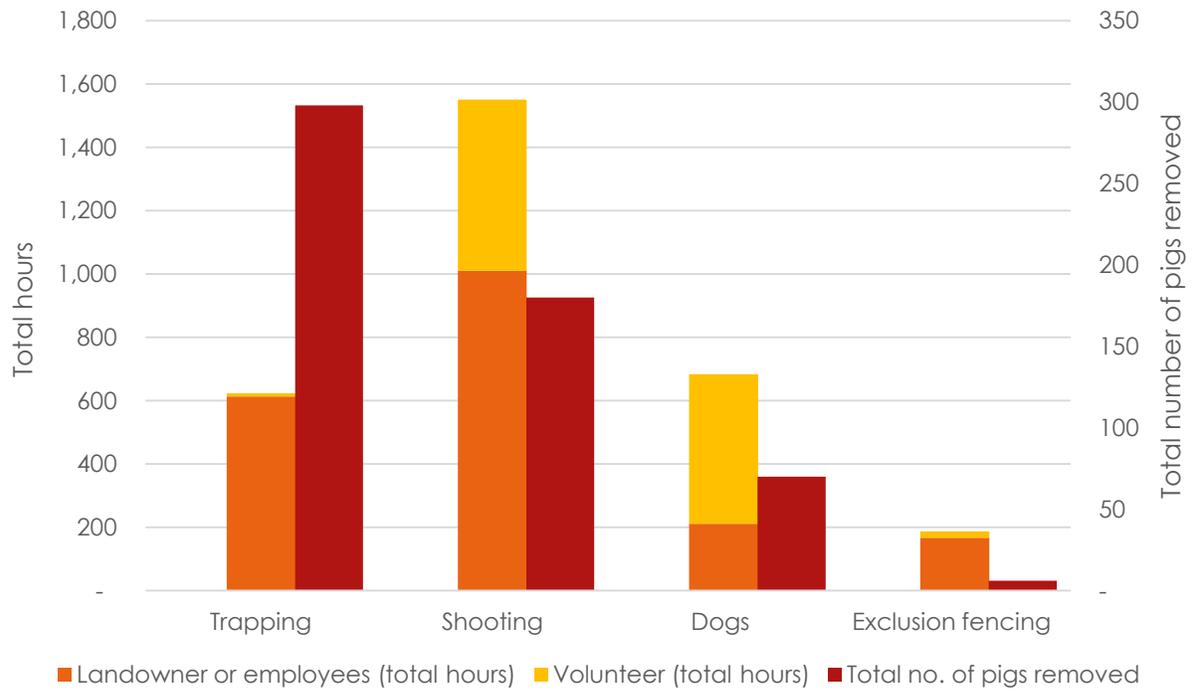
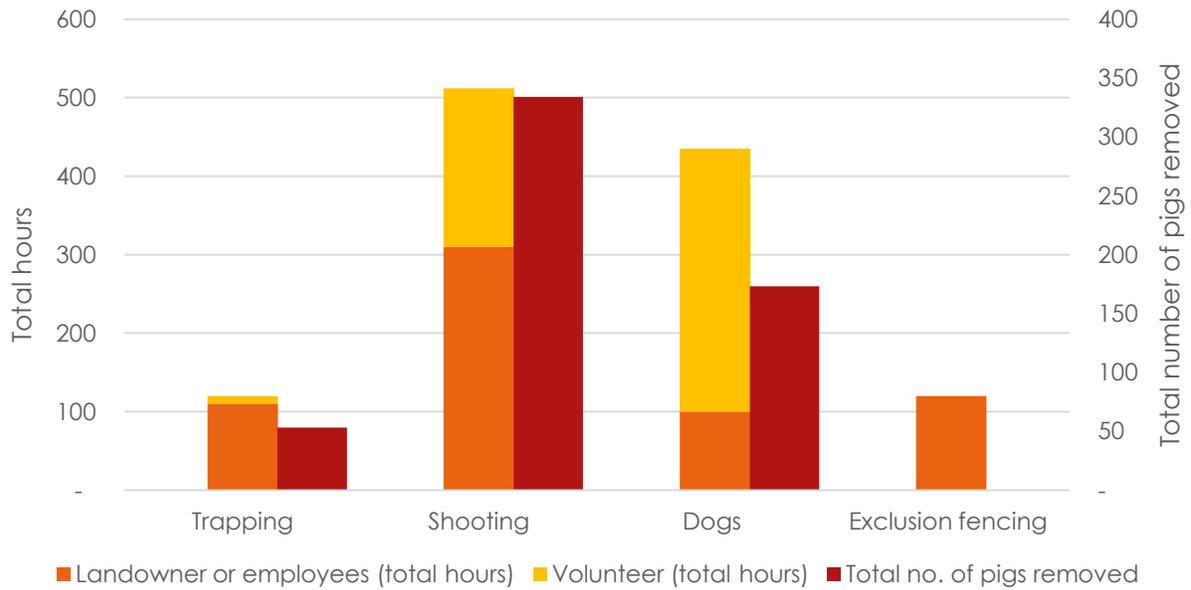


Chart 8: Hours spent controlling feral pigs and feral pigs removed, by person and method – 2016



Chart 9: Number of hours spent controlling feral pigs and total feral pigs removed, by method – 2015



### Further insights

Phone follow-up was undertaken to understand some of the responses to the management response questions reported in the survey. All respondents who were contacted considered their time estimates to be on the conservative side.<sup>11</sup>

<sup>11</sup> It is not uncommon for landholders to underestimate reported losses. For example, Mitchell and Dorney (2002, p.2) reported losses from feral pigs were underestimated by 37 per cent.

## 5.4. Calculating the economic impacts arising from feral pigs

### Main findings

- The total economic impact of the damage and management responses reported by survey respondents is estimated to be \$1.16 million over the three-year period. This includes an economic impact of \$0.56 million in 2017 – an increase of 111 per cent from 2015.
- The largest economic impact was damage to pasture; estimated to be half the economic cost over the three-year period.
- Extrapolating these results out to the wider population of surveyed farming landowners, suggests a total economic impact of \$1.65 million over the three-year period. Around half of this impact (\$0.80 million) occurred in 2017.
- Economic impacts increased for all damage and management response categories between 2015 and 2017.

### Survey results and further analysis

The survey did not specifically ask respondents to quantify the costs they incurred as a result of feral pigs on their properties. The estimates derived in this section have, instead, been determined through attributing monetary values to the damage caused by feral pigs (section 5.2) and time spent in response to feral pigs (section 5.3) as reported in the survey. These values have been determined from phone follow-up with respondents and third-party sources. The information sources and key assumptions are listed in Technical Appendix A.

The estimates derived from the survey have also been extrapolated to the wider population of surveyed primary production landowners. As little was known about the 200 non-responding farming landowners (non-respondents), a simple area-based extrapolation methodology was adopted whereby the characteristics of the 40 respondents were assumed to be the same as the 200 non-respondents (further details of the methodology used can be found in Technical Appendix 1A).

Ideally, detailed follow-up surveying would be conducted to test the accuracy of this approach for each impact category. However, this was not possible within the scope of this report.

### Total economic impact

The total economic impact of the damage and management responses reported by survey respondents is estimated to be \$1.16 million over the three-year period. This includes an economic impact of \$0.56 million in 2017, which is an increase of 111 per cent from 2015 (Tables 8 and 10).

Extrapolating these results out to the wider population of surveyed farming landowners, suggests a total economic impact of \$1.65 million over the three-year period (Table 7). Around half of this impact (\$0.80 million) occurred in 2017 (Table 8).

The largest economic impact was damage to pasture; estimated to be half of the total economic impact over the three-year period (Table 7 and Chart 10). Fencing-related impacts were the next most significant area. Total fencing-related impacts have been estimated at \$226,724 between 2015 and 2017. This includes costs for fencing damage (\$192,238) and hours spent by the landowner or their employees, or a volunteer (\$34,486) using this controlling method.

*Table 7: Economic impacts – 2015-17*

Type	Estimated \$ impact	
	Survey respondents	All landowners
<b>Fencing</b> – damage	134,819	192,238
<b>Fencing</b> – hours	24,186	34,486
<b>Trapping</b> – hours	52,800	75,287
<b>Shooting</b> – hours	145,800	207,895
<b>Dogs</b> – hours	84,400	120,345
<b>Revegetation</b> – damage	87,120	124,224
<b>Pasture</b> – damage	583,450	831,938
<b>Stock</b> – damage	47,250	67,374
<b>TOTAL</b>	<b>1,159,825</b>	<b>1,653,788</b>

Chart 10: Economic impacts by type – 2015-17

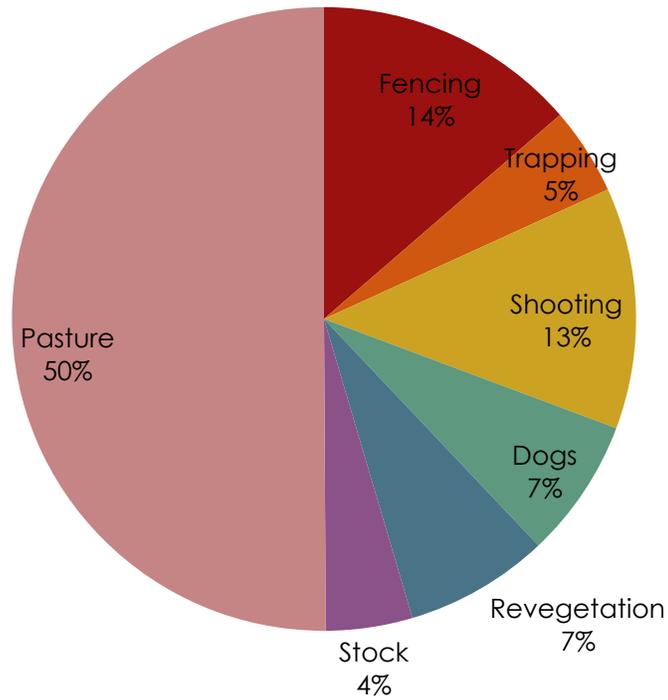


Table 8: Economic impacts – 2017

Type	Estimated \$ impact	
	Survey respondents	All landowners
<b>Fencing</b> – damage	71,754	102,314
<b>Fencing</b> – hours	6,102	8,700
<b>Trapping</b> – hours	31,150	44,417
<b>Shooting</b> – hours	77,500	110,507
<b>Dogs</b> – hours	34,150	48,694
<b>Revegetation</b> – damage	75,240	107,284
<b>Pasture</b> – damage	245,000	349,344
<b>Stock</b> – damage	17,250	24,597
<b>TOTAL</b>	<b>558,146</b>	<b>3,378,876</b>

Table 9: Economic impacts – 2016

Type	Estimated \$ impact	
	Survey respondents	All landowners
<b>Fencing</b> – damage	24,904	35,511
<b>Fencing</b> – hours	14,357	20,471
<b>Trapping</b> – hours	15,650	22,315
<b>Shooting</b> – hours	42,700	60,886
<b>Dogs</b> – hours	28,500	40,638
<b>Revegetation</b> – damage	7,920	11,293
<b>Pasture</b> – damage	188,650	268,995
<b>Stock</b> – damage	15,000	21,388
<b>TOTAL</b>	<b>337,681</b>	<b>481,498</b>

Table 10: Economic impacts – 2015

Type	Estimated \$ impact	
	Survey respondents	All landowners
<b>Fencing</b> – damage	38,161	54,413
<b>Fencing</b> – hours	3,727	5,314
<b>Trapping</b> – hours	6,000	8,555
<b>Shooting</b> – hours	25,600	36,305
<b>Dogs</b> – hours	21,750	31,013
<b>Revegetation</b> – damage	3,960	5,647
<b>Pasture</b> – damage	149,800	213,599
<b>Stock</b> – damage	15,000	21,388
<b>TOTAL</b>	<b>263,997</b>	<b>376,433</b>

Impacts increased for all damage and management response categories between 2015 and 2017. The greatest increase in economic impacts in was in revegetation (increasing around 20 times - although this was from a low base in 2015), trapping (increasing fourfold) and shooting (doubling of impact).

### 5.5. Concluding remarks

Based on respondent observations, the population of pigs appears to have remained relatively consistent over recent years. However, there are limitations to relying solely on these results. The presence and number of pigs are more reliably evaluated by observing signs of their activity and impact. On these points, the results of the survey are quite different, with the reported economic impact of feral pig activity increasing.

The survey identified the types and extent of feral pig damage in recent years, and the extent of management controls in response to these. The results suggest that small numbers of feral pigs can cause significant damage to landowners' properties. This is significant, given the area impacted is some of the most productive land on the Island. The opportunity cost of this lost production has not been included in this analysis.

The damage caused by feral pigs has increased, and substantially for some type of impacts, over the past three years. The management response to these impacts has also increased over the same period.

There are economic impacts from this damage, and the associated management response. While economic impacts were not quantified by respondents, estimates have been able to be derived using local specialist advice, survey respondent follow-up, and other third-party sources. Impacts have also been estimated for the wider landowner population. To further refine these estimates, following-up with non-respondents is suggested, as well as further research of costs which may be underestimated.

## 6. References

Australian Bureau of Statistics (ABS) (2018) "Kangaroo Island – regional statistics", available at [http://stat.abs.gov.au/itt/r.jsp?RegionSummary&region=407011145&dataset=ABS\\_REGIONAL\\_ASGS&geoconcept=REGION&measure=MEASURE&datasetASGS=ABS\\_REGIONAL\\_ASGS&datasetLGA=ABS\\_NRP9\\_LGA&regionLGA=REGION&regionASGS=REGION](http://stat.abs.gov.au/itt/r.jsp?RegionSummary&region=407011145&dataset=ABS_REGIONAL_ASGS&geoconcept=REGION&measure=MEASURE&datasetASGS=ABS_REGIONAL_ASGS&datasetLGA=ABS_NRP9_LGA&regionLGA=REGION&regionASGS=REGION).

Bates, V., (2018), Department of Environment and Water (DEW), pers. comm., 27 March 2018.

DEWNR (2017) "Feral pigs in the cross hairs of Kangaroo Island", available at [https://www.environment.sa.gov.au/Home/Full\\_newsevents\\_listing/News\\_Events\\_Listing/170605-feral-pigs-kangaroo-island](https://www.environment.sa.gov.au/Home/Full_newsevents_listing/News_Events_Listing/170605-feral-pigs-kangaroo-island).

Dohle, L. (2018), Primary Industries and Regions South Australia (PIRSA), pers. comm., 26 March 2018, 9 May 2018.

Gentle, M., Phinn, S. and Speed, J. (2011) "Assessing pig damage in agricultural crops with remote sensing – Bureau of Rural Sciences Australian Pest Animal Management Program Final Report".

Long, K. and Robley, A. (2004) "Cost effective feral animal exclusion fencing for areas of high conservation value in Australia: Catalogue of fence designs, Rylah Institute for Environmental Research Department of Sustainability and Environment Heidelberg, Melbourne, Available at: <http://www.environment.gov.au/system/files/resources/b39c119e-c58a-4473-9507-db68da31a95c/files/catalogue.pdf>.

Markopoulos, N., (2018), DEW, pers. comm., 3 April 2018, 9 May 2018.

Mitchell, J. and Dorney, W. (2002) "Monitoring Systems for Feral Pigs: Monitoring the Economic Damage to Agricultural Industries and the Population Dynamics of Feral Pigs in the Wet Tropics of Queensland - Final Report to Bureau of Resource Science National Feral Animal Control Program".

NSW Department of Primary Industries (2017) "Feral pig biology and distribution", Accessed at <https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/pest-animals-in-nsw/feral-pigs/feral-pig-biology>.

Office for Volunteers (2010) "The Economic Value of Volunteering in South Australia" available at to [http://www.ofv.sa.gov.au/\\_\\_data/assets/pdf\\_file/0017/8018/economic-value-of-volunteering-in-sa2011.pdf](http://www.ofv.sa.gov.au/__data/assets/pdf_file/0017/8018/economic-value-of-volunteering-in-sa2011.pdf).

Loates, B. (2018), Office for the Commissioner for Kangaroo Island, pers. comm., 11 March 2018.

Office of the Commissioner for Kangaroo Island (2018) "The Economic Value of Volunteering in South Australia" available at to [http://www.ofv.sa.gov.au/\\_\\_data/assets/pdf\\_file/0017/8018/economic-value-of-volunteering-in-sa2011.pdf](http://www.ofv.sa.gov.au/__data/assets/pdf_file/0017/8018/economic-value-of-volunteering-in-sa2011.pdf).

Peevor, S. (2017) "Pest Animal Impacts in the Anangu Pitjantjatjara Yankunytjatjara Lands", report prepared for Rural Solutions SA, unpublished.

## Technical Appendix A

### Extrapolation of survey to non-respondents

The estimates derived from the survey have been extrapolated to the wider population of surveyed primary production landowners who did not respond to the survey, using a simple area-based extrapolation methodology. This methodology was favoured because the feral pig impacts collected as part of this study were assumed to be related to the area of the property (eg. fencing damage).

Under this methodology, the pattern of responses of the 40 respondents was assumed to be the same as the 200 non-respondents. However, the impacts were extrapolated out to the total estimated area of primary production land based on spatial information provided by OCKI (the respondents' property sizes) and DEW (the total area impacted by feral pigs and land use types).

### Fencing

In calculating total fencing damage costs, an estimate of \$4,375 per km of fencing was used (excluding labour), which is based on discussions with the top two largest respondents<sup>12</sup> (together making up 60 per cent of the total fencing impacted) and Primary Industries and Regions South Australia (PIRSA).<sup>13</sup> This compares with an earlier study into the costs of exclusion fencing for feral pigs.<sup>14</sup> The cost of labour was excluded to not double count the hours spent on fencing as a controlling method.

The hourly labour rate used for fencing as a controlling method by the landowner, their employees, and volunteers was \$32.63 per hour. This is based on a 2010 study commissioned by the Office for Volunteers, Government of South Australia, indexed by the Australian Bureau of Statistics' Consumer Price Index (CPI) to 2017 dollars.<sup>15</sup> This compares to an earlier Queensland study<sup>16</sup> into the economic damage to agricultural industries of feral pigs, which estimated an hourly labour rate of \$11.52 in 2002 which, when indexed by CPI, is \$39.76 in 2017 dollars.

### Pasture

The survey recorded the total area of pasture damaged by feral pigs. It did not record any effort spent on activities to rehabilitate pastures. The total area of damaged pasture was multiplied by the cost of pasture restoration to generate this impact estimate. A rate of \$350 per hectare was provided by the Department of Environment and Water (DEW), based on the cost to renovate a

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<sup>12</sup> The figure of \$4,375 is an average of two, similar, responses provided by the two respondents.

<sup>13</sup> Dohle, L. (2018), PIRSA, pers. comm., 26 March 2018 (included feedback from Landmark Kingscote and Private Fencing Contractor).

<sup>14</sup> Refer to Long and Robley (2004), p.C.20.

<sup>15</sup> Refer to [http://www.ofv.sa.gov.au/\\_data/assets/pdf\\_file/0017/8018/economic-value-of-volunteering-in-so2011.pdf](http://www.ofv.sa.gov.au/_data/assets/pdf_file/0017/8018/economic-value-of-volunteering-in-so2011.pdf).

<sup>16</sup> Refer to Mitchell and Dorney (2002), p. 9.

perennial pasture.<sup>17</sup> This estimate includes labour but does not include capital depreciation for levelling machinery. Furthermore, it does not include the lost production (opportunity cost) from any reduced stock capacity that might arise from pasture degradation.

As the survey did not ask respondents to report the hours spent on pasture restoration, and given the DEW estimate includes labour, no further adjustments have been made to this estimate. Noting this estimate does not include capital depreciation for leveling machinery, or any reduced production, it can be considered to be a conservative underestimate.

### Trapping

The survey only asked for the total hours spent trapping. It did not ask for any trapping equipment-related costs. The hourly rate used for trapping for the landowner, their employees, and volunteers was \$50.00. This figure was provided by DEW, based on estimates of costs of a limited number of private firms or individuals carrying out similar services.<sup>18</sup> This is considered to be a conservative estimate, and further research may assist to refine these costs.

### Shooting

The survey only asked for the total hours spent shooting. It did not ask for any shooting equipment-related costs. The hourly rate used for shooting for the landowner, their employees, and volunteers was \$50.00. This was provided by DEW, based on estimates of costs of a limited number of private firms or individuals carrying out similar services.<sup>19</sup> This is considered to be a conservative estimate, and further research may assist to refine these costs.

### Dogs

The survey only asked for the total hours spent using dogs. It did not ask for any further dog-related costs. The hourly rate used for dogs for the landowner, their employees, and volunteers was \$50.00. This was provided DEW, based on the costs of a limited number of private firms or individuals carrying out similar services.<sup>20</sup> This is considered to be a conservative estimate, and further research may assist to refine these costs.

### Stock

The survey asked respondents to report the total number of stock (head) damaged or lost as a result of feral pigs. It did not ask whether that stock was sheep or cattle, or the type of sheep or cattle. Further, it did not ask respondents to report total hours spent replacing stock.

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<sup>17</sup> Bates, V., (2018), DEW, pers. comm., 27 March 2018.

<sup>18</sup> Markopoulos, N., (2018), DEW, pers. comm., 3 April 2018.

<sup>19</sup> Markopoulos, N., (2018), DEW, pers. comm., 3 April 2018.

<sup>20</sup> Markopoulos, N., (2018), DEW, pers. comm., 3 April 2018.

According to estimates provided by PIRSA and Landmark Kingscote, the price of stock varies considerably – from \$100 a head for merino sheep through to \$1,500 a head for a cow (Table A1).

*Table A1: Average cost of stock – 2017*

Stock	Cost (\$)
Sheep – merino	100
Sheep – prime lambs	150
Cattle – steers	1,200
Cattle – cows	1,500

The respondents contacted via follow-up phone call stated the damage they reported was to lambs, as a result of damage to pasture and predation. In the absence of detailed stock information on the farming landowner population, the average value of lambs has been used to determine the cost of feral pig damage. This results in an estimate of \$313,500, compared to a maximum of \$3.14 million if 100 per cent cows were used. (It is noted that there are over 26 times more sheep than cattle on the Island).<sup>21</sup>

### Revegetation

The survey recorded the total area of revegetation damaged by feral pigs. It did not record any effort spent on revegetation activities, or revegetation materials. An estimate value of \$1,320 per hectare has been used, which is based on 600 plants at \$2.20 each (this excludes labour). This estimate was provided by DEW.<sup>22</sup>

<sup>21</sup> Refer to

[http://stat.abs.gov.au/itt/r.jsp?RegionSummary&region=407011145&dataset=ABS\\_REGIONAL\\_ASGS&geoconcept=REGION&measure=MEASURE&datasetASGS=ABS\\_REGIONAL\\_ASGS&datasetLGA=ABS\\_NRP9\\_LGA&regionLGA=REGION&regionASGS=REGION](http://stat.abs.gov.au/itt/r.jsp?RegionSummary&region=407011145&dataset=ABS_REGIONAL_ASGS&geoconcept=REGION&measure=MEASURE&datasetASGS=ABS_REGIONAL_ASGS&datasetLGA=ABS_NRP9_LGA&regionLGA=REGION&regionASGS=REGION).

<sup>22</sup> Bates, V., (2018), DEW, pers. comm., 27 March 2018.

## PROJECT BRIEF

### FERAL PIGS MANAGEMENT PROGRAM

#### INTRODUCTION

The Office of the Commissioner for Kangaroo Island (OCKI) and Natural Resources Kangaroo Island (NRKI) are collaborating on a project to undertake a survey of landowners affected by feral pigs to identify the economic and environmental impact for the purpose of preparing a funding submission.

This brief sets out the background to feral pig management on KI, identifies the scope for the project and the methodology proposed to be used, and the outcomes sought from the project.

It has been developed with input from the Committee that has been established by OCKI and NRKI to assist in developing strategies for feral pig management on KI.

#### BACKGROUND

*Feral Animal Management Team:*

The NRKI feral animal team is funded by the Australian Government to:

- primarily eradicate feral goats and fallow deer from Kangaroo Island and ongoing monitoring;
- assist landowners manage priority pest species with a focus on feral pigs;
- implement the domestic goat and domestic deer management program (including development of regional policy, permitting and property inspections); and
- undertake biosecurity risk incursion response to prevent new emerging species from becoming established.

The NRKI feral animal team has an established milestone to engage with 10 landowners on an annual basis, but are keen to assist those that request assistance.

Support provided by the team involves providing traps, assisting with “setting up”, coordinating cross-tenure management approaches, providing advice and support for feral pig control on public land, undertaking surveys, responding to new emerging populations of pigs, and engagement with landowners through regular one-on-one meetings.

The focus has been to work with affected landowners to empower them to undertake control work in the most cost-effective manner.

The NRKI feral animal team is also involved in a State-wide discussion on possible changes to Natural Resource Management legislation to deter new incursions, deliberate release, and movement of feral pigs across the State.

The total annual Australian Government contribution to the animal and plant control program on KI is approximately \$200,000 (until June 2018). The NRM levy contributes approximately \$20,000 per annum to the program. There is also significant in-kind support provided by DEWNR and Biosecurity SA to the program.

The team comprises four staff: two are specifically focussed on feral animals, and two on invasive weeds. The NRM levy includes management support for feral animal programs.

About 10% of the total time allocated to the NRKI feral animal team has been dedicated to feral pig control on the western end of KI. The team has achieved a considerable amount of success working with landowners who are motivated and committed to achieving control.

From 2002 to 2010, NRKI had a large financial contribution from the Invasive Animals Cooperation Centre for extensive baiting trials, and extra funding from a wetlands project to reduce pig numbers in the South West River Catchment (Grassdale).

Included as Attachment 1 is *Report on Feral Pigs on Kangaroo Island* prepared by NRKI and covers:

- history and population numbers of pigs on KI;
- challenges of pig management in comparison to goats, deer and cats;
- numbers of farmers utilising the team's services in the past three years;
- issues impacting on the success of various pig management strategies; and
- comments on eradication as opposed to management.

It is clear from the work being undertaken to date that there is more to be undertaken in relation to:

- improving knowledge about pig distribution and population dynamics;
- responding to new population incursions;
- continuing coordinated control programs;
- trialling new methods of control;
- monitoring and reviewing control programs; and
- addressing social issues linked to pig management on KI.

#### *Feral Pig Management Plan*

The Feral Pig Management Plan (2008 – 2012) was developed to inform and guide actions of the NRKI feral animal team. It now requires review as part of an ongoing program of management and control. The Plan was developed by Pip Masters et al. and is included as Attachment 2 is the Plan.

#### *Feral Pig Survey – November 2014*

A survey was undertaken in November 2014 inviting landowners to respond to a range of questions related to experience with feral pigs. It is clear from the results of the survey responses were not received from all affected farmers and the survey failed to quantify the impact of feral pig damage on properties.