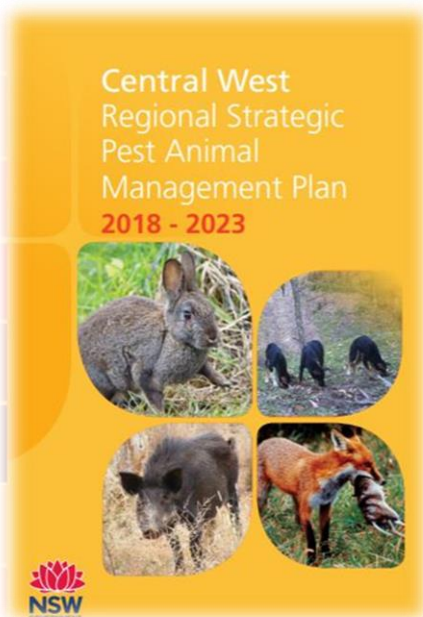




# Monitoring, Evaluation, Reporting and Improvement (MERI) framework for pest animal management in NSW



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## Executive summary

This Monitoring, Evaluation, Reporting and Improvement (MERI) framework will help improve the consistency and comprehensiveness of data collection and reporting on pest animal management in NSW. It provides background on the purposes and challenges of MERI and presents a wide range of parameters and metrics that could be used to track the performance of pest animal management at input, output and outcome levels.

Given limited resources, it is important to identify a core set of metrics for reporting at local, regional and State levels. This document presents the core State-level metrics that have been agreed to by the State Pest Animal Committee and which will therefore need to be compiled at the Regional Pest Animal Committee level for annual reporting. However, regional and local committees may want to consider additional metrics that meet their more localised information requirements.

A MERI framework is only as good as the data available to support it. Data on most of the core State-level metrics is already being collected in some way, but there are efficiencies to be had in better data management systems that prompt more comprehensive data input and that facilitate more automated data collation and graphical outputs that allow spatial and temporal comparisons. Ongoing development of NSW Government biosecurity and natural resource management databases should enhance data collection and the transparency of pest animal management performance in NSW.

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# 1 Introduction

Local Land Services (LLS) regions, in consultation with Regional Pest Animal Committees (RPACs), have developed Regional Strategic Pest Animal Management Plans (RSPAMPs) to guide pest animal management in each of the 11 LLS regions throughout New South Wales. The plans aim to prioritise pest animals, clarify expectations around management and help guide investment.

The RSPAMPs aim to:

- improve community engagement and expertise in pest animal management
- improve monitoring and reporting of pest animal presence, impacts and management activities
- reduce the economic, environmental and social impacts of pest animals.

Most RSPAMPs have identified Key Performance Indicators (KPIs) for priority pest animals, although in some cases the proposed KPIs in these plans are actually outputs. This statewide Monitoring, Evaluation, Reporting and Improvement (MERI) framework will help guide specific forms of data collection to ensure greater consistency between regions and to allow collation of data at regional and state levels. It will also help regions to set targets and monitor performance against them.

RSPAMPs will be evaluated in the middle (2021) and at the end (2023) of their terms. Data to support these evaluations can be obtained from a range of sources, including:

- Local Pest Plans and Operational Plans
- LLS databases – MyLand, Ratelt, BioMAP
- land manager surveys
- reports of sightings and impacts by the community (e.g. through FeralScan and other mapping processes)
- reports of new incursions (e.g. through the DPI Non-Indigenous Animals reporting system).

Data collected at local and regional levels will support individual RSPAMP evaluation. This State MERI framework identifies the core metrics that need to be collected by all regions to support State-level data collation and evaluation. It also identifies a wider range of metrics that could be considered by individual pest animal management programs or regions to suit their own needs. The framework also provides some guidance on issues and options in designing MERI programs that are relevant to local, regional and state activities.

Effective and efficient data management systems are fundamental to good MERI processes. The development of the MyLand and Biosecurity Case Management systems will provide important prompts for required data collection as well as the means to efficiently collate and analyse data in various ways. Consideration also needs to be given to how other significant datasets such as the Pests and Weeds Information System (PWIS, NPWS) and FeralScan can feed into the MERI process.

Transparency of information is an important principle for this State MERI Framework and will facilitate:

- improved data collection and entry – i.e. a transparent data system will show how the data can support decision-making and will highlight data gaps

















### 3 Program Logic

Constructing a ‘Program Logic’ helps to clarify the steps that are required to achieve the ultimate outcome of reduced pest animal impacts. The below Program Logic (**Table 2**) is broadly aligned with the four goals of the Invasive Species Plan 2018-2021. **Table 3** provides more detail about measures for activities, outputs and outcomes.

**Table 2:** Program Logic for pest animal management in NSW

**Vision: Working together to reduce the negative impacts of pest animals in NSW**

Activities	Outputs	Short-term outcomes (0-1 years)	Medium-term outcomes (1-3 years)	Longer-term outcomes (3-5 years)	Goals
<p><b>1. Leadership and coordination</b></p> <p><i>a. SPAC, RPACs and RSPAMPs in place</i></p> <p><i>b. Cross-tenure local management plans to be developed for priority pest animals in priority areas</i></p> <p><b>2. Regulatory support</b></p> <p><i>a. Biosecurity Act, regulations and procedure in place and subject to ongoing review</i></p>	<p>Stakeholders engaged</p> <p>New partnerships established and existing partnerships enhanced</p> <p>Committee meetings held</p> <p>Workshops delivered</p> <p>Plans developed, implemented and reviewed</p>	<p>Increased availability of information on pest animal threats and management options</p> <p>Increased awareness of legal responsibilities for pest animal management</p> <p>Increased motivation, knowledge and skills of landholders to undertake best practice pest animal management and to</p>	<p>Different stakeholders starting to work together</p> <p>Increased capacity to deliver pest animal management</p> <p>More stakeholders complying with obligations</p> <p>More management tools available and tailored to local situations</p>	<p>Increased level of shared responsibility</p> <p>Improved cross-tenure coordination</p> <p>More stakeholders engaging in best practice pest animal management</p> <p>Management becomes more effective through improved tools, greater coordination and</p>	<p><b>Goal 1:</b> Capacity building – ensure NSW has the ability and commitment to manage invasive species.</p> <p><b>Goal 2:</b> Exclude – prevent the establishment of new invasive species</p> <p><b>Goal 3:</b> Eradicate or contain – eliminate, or prevent the spread of new invasive species</p>

<p><b>3. Building knowledge</b></p> <p><i>a. Improve suite of monitoring and management tools</i></p> <p><i>b. Improve knowledge of pest animal distribution, relative abundance and impacts</i></p> <p><i>c. MERI processes in place at local, regional and state levels</i></p> <p><b>4. Awareness, understanding and capacity</b></p> <p><i>a. Increase landholder awareness and understanding of pest animal impacts, management options and Biosecurity Act obligations</i></p> <p><i>b. Maintain a comprehensive suite of extension materials as well as formal landholder training in pesticide use</i></p>	<p>Best practice guides developed Information distributed</p> <p>Training sessions conducted</p> <p>Pest animal management undertaken – records of effort (time, area, baits etc) and result (pest animal density and impacts)</p> <p>Inspections conducted</p> <p>Data collected and recorded</p> <p>New incursions identified</p> <p>Eradication and containment programs</p>	<p>participate in coordinated programs</p> <p>Increased government staff capacity to engage the community, implement the Biosecurity Act and participate in incursion management</p> <p>Consistent statewide local management plan template in place</p> <p>Improved monitoring and reporting of pest animal occurrence (including new incursions), impacts and management</p>	<p>Local management plans in place for priority pest animals in priority areas</p> <p>Improved protection of priority assets</p> <p>Improved management of new incursions and high-risk pathways</p>	<p>appropriate scale and intensity of control</p> <p>Pest animal risks and/or impacts are reduced</p> <p>Increased capacity and more efficient monitoring and management processes to ensure effective management of increasing incursion reports</p>	<p><b>Goal 4:</b> Effectively manage – reduce the impacts of widespread invasive species</p>
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<p><i>c. Formal training of government staff in vertebrate pest management, emergency management, community engagement etc.</i></p> <p><i>d. Increase awareness and understanding of general community about pest animal threats and the need to undertake management</i></p> <p><b>5. On-ground prevention and management</b></p> <p><i>a. Procedures in place for reporting and following up on new incursions</i></p> <p><i>b. Encourage community involvement in surveillance</i></p> <p><i>c. Biosecurity Zones in place as required (e.g. cane toads)</i></p> <p><i>d. Asset-based approach for management of widespread pest animals</i></p>					
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## 4 Performance measures for pest animal management

The ultimate measure of the success of pest animal management is whether impacts are being reduced to 'acceptable' levels. Where pest animal eradication isn't possible (the usual scenario for widespread pest animals), there will always be some pest animals remaining in the landscape and therefore some impact. It is usually unrealistic to set a Key Performance Indicator of 'zero impact' and stakeholder consultation needs to be undertaken to derive more realistic long-term objectives for pest animal management programs. Examples of metrics that pest animal managers can consider to determine the success of management programs are provided below.

Because it is difficult and expensive to measure some forms of pest animal impact, pest animal density is often used as a surrogate for impact. This can be a reasonable approach where there is some knowledge about the relationship between pest animal density and impact.

Although reporting on total number of pest animals removed in a program is not a particularly useful metric as a stand-alone figure, information on trends in pest animals removed per unit time or area within and between control programs can provide a rough indication of whether a management strategy is working at achieving a sustained reduction in pest animal populations – e.g. if a similar number of feral pigs is being shot per hour in annual aerial shooting programs over the same area at the same time of the year, then the program probably isn't overcoming the natural rate of feral pig population increase and the strategy needs to be revised. Ideally, long-term aerial shooting programs should incorporate some aerial survey work to track the impact of the program on pest animal density.

On their own, metrics such as number of baits laid or dollars spent are not particularly useful and can even be misleading. They require some context such as area of operations, changing density of target species and whether change in management effort is being driven by stakeholder demand, resource availability or a scientific assessment of what is required to reduce pest impacts.

Effective capacity building is fundamental to effective pest animal management and hence there is a focus on measures against this goal in the below table (**Table 3**).

**Appendix C** provides more detail on the type of metrics that could be collected associated with a particular pest animal species.

**Table 3:** Potential metrics to measure achievements at local, regional and State levels

Objectives	Activities	Potential metrics
<b>GOAL 1. CAPACITY BUILDING</b>		
Improved general public understanding of biosecurity threats and management approaches as this will help support ‘social licence’ for managing pest animals as well as encourage public involvement in reporting biosecurity threats	Produce and disseminate information materials	Number of targeted communications of various forms (e.g. extension materials, e-newsletters, media coverage, social media, community meetings, email and text reminders etc.) and access figures where available (e.g. on-line page views)
Improved capacity and KASA (Knowledge, Awareness, Skills, Attitude) of pest animal coordinators and biosecurity officers about pest animal impacts, Biosecurity Act obligations and best practice pest animal management	Formal (e.g. Tocal and ACO accreditation) and informal training	Number of government staff involved in pest animal management  Number of government staff participating in formal and informal training events (including routine and emergency management) and KASA measurements at and post such events
Improved governance of decision-making and planning bodies (e.g. RPACs, local management groups)	Implement sound governance processes (Terms of Reference, record keeping and reporting, transparency of activities etc.) at state, regional and local levels	Data on number of active local management plans, meetings held, minutes taken, partner organisations collaborating on design, implementation and review of plans
Improved KASA (Knowledge, Awareness, Skills, Attitude) of landholders about pest animal impacts, Biosecurity Act obligations and best practice pest animal management	Produce information materials targeting state, regional and local levels  Disseminate information via field days, social media, e-newsletters, websites	Number of targeted communications of various forms (e.g. extension materials, e-newsletters, media coverage, social media, community meetings, email and text reminders etc.) and access figures where available (e.g. on-line page views)  Number of landholders participating in formal vertebrate pesticide training  Number of landholders participating in other pest animal training activities  Improvements in knowledge, awareness, skills and attitude (KASA) metrics post meetings / education programs – as determine by baseline and follow-up surveys

<p>Increased number of landholders and area of land involved in strategic, planned, coordinated pest animal management</p>	<p>Develop regional and local pest animal management plans in collaboration with private and public landholders</p> <p>Coordinate implementation of pest animal plans</p> <p>Support non-government pest animal management coordinators (e.g. mentoring, provision of meeting and administration facilities, incentives for landholder participation such as subsidised baits)</p>	<p>Number of active pest animal management plans</p> <p>Number of landholders participating in coordinated management programs</p> <p>Biosecurity Act procedure statistics (biosecurity threat reports, inspection, education, compliance, enforcement)</p> <p>Area of land covered by management plans and activities (ha, sq. km.)</p> <p>Land tenure (private enterprise type, conservation estate, forests etc).</p> <p>Proportion of priority pest animal management areas that are covered by a pest animal management plan and associated management groups and activities (%)</p> <p>Length of tenure of non-government pest animal management coordinators</p>
<p>Improved understanding of pest animal distribution, relative abundance and impacts</p>	<p>Pest animal mapping at local, regional and state levels</p> <p>Routine monitoring and reporting of pest animal impacts as part of ongoing management programs</p> <p>Research into pest animal impacts</p>	<p>Statewide maps for priority pest animals compiled every five years (Y/N)</p> <p>Regional and local pest animal management plans include up-to-date maps of likely pest animal distribution and relative abundance/activity (and impact data where available) (Y/N)</p>
<p>Improved suite of monitoring and management tools</p>	<p>Maintain and increase research capacity</p> <p>Prioritise research to ensure sufficient management tools are in place to support integrated management of all priority pest animals</p>	<p>Number of government pest animal research staff</p> <p>Funding for research projects under way (trend line of \$ per year)</p> <p>Qualitative assessment of whether there are situations where there are inadequate control monitoring and control tools to address pest animal impacts in some situations</p>

	Establish density: damage relationships for priority pest animals and assets	
Budgets match a realistic assessment of the amount of resources required to achieve adequate scale and intensity of pest animal management	Data on pest animal impacts and the ongoing resources of an effective management strategy is compiled and presented to public and private funders	Resources for management activities relative to observed outcomes (e.g. changes in landholder participation, pest animal density, asset condition etc.)
<b>GOAL 2. EXCLUDE</b>		
Increased community awareness about the threat of new exotic species and community actively contributing to surveillance and reporting activities	Produce and disseminate information materials	Number of targeted communications of various forms (e.g. extension materials, e-newsletters, media coverage, social media, community meetings, email and text reminders etc.) and access figures where available (e.g. on-line page views)
Increased understanding of higher risk pathways for incursions to help focus surveillance	Record and analyse incursion report data	Annual analysis of incursion data at state level (Y/N)
<b>GOAL 3. ERADICATE OR CONTAIN</b>		
The community understands how to report incursions and there is a clear process for government agencies to follow up on such reports	Provide simple and accessible options for the community to report incursions  Develop and promote procedure for government staff to receive and follow-up on incursion reports	Number of reports to DPI on-line reporting relative to other reporting avenues  Time taken to follow up on incursion reports  Follow-up activities (e.g. number of communication activities in local area, number of surveillance activities etc.)  Data on eradication attempts (e.g. number of eradication programs, duration/cost/area of program, outcome etc.)
Defined or isolated populations of high-risk pest animals are effectively contained at state and regional levels	Biosecurity Zones (state level) or containment lines (regional level) in place as required	Contained area (ha or sq km) which may change over time (increase or decrease) depending on the success of the containment program  Number of containment line breaches and data (e.g. number of animals removed and area of removal) on managing breaches

**GOAL 4. EFFECTIVELY MANAGE (established pests)**

<p>Land managers understand the key assets (economic, environmental, social amenity) to be protected and therefore the objectives of pest animal management</p>	<p>Document key assets (economic, environmental, social amenity) to be protected, including baseline and target condition of asset</p>	<p>Data on assets (e.g. increase or decrease in the density or abundance and area of threatened species)</p>
<p>Land managers effectively reduce pest animal impacts through coordinated and integrated management employing a range of control measures</p>	<p>A range of pest animal control measures employed, including at least one 'primary' technique as identified in Standard Operating Procedures</p>	<p>Statistics on one or more of the following pest animal management approaches:</p> <ul style="list-style-type: none"> <li>• aerial baiting</li> <li>• ground baiting</li> <li>• aerial shooting</li> <li>• ground shooting</li> <li>• trapping</li> <li>• biological control</li> <li>• exclusion fencing</li> <li>• cultural practices or enterprise substitution.</li> </ul>
<p>Reduce the distribution and relative abundance of pest animals</p>	<p>Pest animal mapping at local, regional and state levels</p>	<p>Local, regional and state maps for priority pest animals which will provide data on: area (ha or sq km) of distribution; density (animals per unit area) or relative abundance (0, L, M, H); and overlap of pest distribution/abundance with maps of key assets to be protected.</p>
<p>Minimise the impact of pest animals on key assets</p>	<p>Implement pest animal management plans in a way that achieves adequate intensity and duration of management</p> <p>Monitor against metrics and targets that have been set before management commences</p>	<p>Metrics depend on the pest animal species but examples include: livestock injury or death from predation (e.g. wild dogs, foxes); population trends of threatened species; and surveying public opinion about impacts of wild deer in urban areas. For some pest animal species, their distribution and density may have to be used as a surrogate for impact. See <b>Appendix C</b> for more detailed about pest animal impact metrics.</p>

<p>A high level of legislative compliance under the Biosecurity Act and Pesticide Control Orders is achieved over time</p>	<p>Promote awareness of Biosecurity Act and Pesticide Control Order obligations to public and private land managers</p> <p>Authorised Officers to follow the published general biosecurity duty procedure</p> <p>Authorised Control Officers to make private landholders aware of their obligations in using vertebrate pesticides</p>	<p>Statistics on activities under each of the seven steps of the general biosecurity duty procedure for pest animals</p> <p>Statistics on compliance with Vertebrate Pesticide Manual and Pesticide Control Order requirements.</p>
<p>Optimise the efficiency of pest animal management</p>	<p>Some metrics can help determine whether awareness, engagement, planning and management activities are having a positive effect in reducing pest animal impacts; however, the challenge is to optimise approaches – i.e. maximising outcomes for a given level of input.</p>	<p>Return on investment metric where the ‘return’ can be measured by change in pest animal density (NOT total numbers removed which is a poor indicator) or preferably in terms of reduced impact.</p>

## 5 Evaluating RSPAMPs

**Tables 4-6** are adapted from the MERI Framework for Regional Strategic Weed Management Plans to provide some consistency in the way that regional committees assess the performance of their regional invasive species management plans. Wherever possible, data collection methods for weeds and pest animal management should be coordinated to reduce costs and to avoid stakeholder fatigue from responding to multiple surveys.

**Table 4:** Indicators and data sources/methods that should be used to address key evaluation questions. Note that this provides a high-level framework for guiding data collection and reporting. More detail about assessing individual outcomes provided in **Table 5**.

Key evaluation questions	Indicators/issues to consider	Data source/method	Responsibility/timing
<b>1. What has been delivered under the plan?</b>			
a. What actions were delivered?	Cross-check of actions against RSPAMP KPIs and associated delivery plans  Extent to which targets for actions (e.g. # inspections) delivered	LLS/RPAC review  Biosecurity Case Management system (when available)	LLS/RPACs - Annually
b. Were there any issues with delivering these actions in terms of scope, timeliness or budget?	Reasons for over/under achievement Reasons for any timeline overruns	LLS/RPAC feedback (reporting)	LLS/RPACs - Annually
c. What lessons have been identified for the future?	Insights from LLS/RPAC members and other stakeholders	LLS/RPAC discussion and consider standardised stakeholder survey (developed in consultation with DPI)	LLS/RPACs - Annually
<b>2. What resources were used in implementing the RSPAMP?</b>			
a. What did different activities cost (time and in-kind)?	Staffing allocations Expenditure records	Standardised reporting template Potential for in-kind to be collected from partners through standardised survey	LLS/RPACs - Annually
b. What were the sources of these resources?	Timesheets Income records	Standardised reporting template Potential for in-kind to be collected from partners through standardised survey	LLS/RPACs - Annually

Key evaluation questions	Indicators/issues to consider	Data source/method	Responsibility/timing
<b>3. What has been achieved in relation to RSPAMP goals?</b>			
a. What progress has been made in ensuring responsibility for pest animal biosecurity is shared?	See <b>Table 5</b>	See <b>Table 5</b>	See <b>Table 5</b>
b. What progress has been made in supporting profitable, productive and sustainable primary industries?	See <b>Table 5</b>	See <b>Table 5</b>	See <b>Table 5</b>
c. What progress has been made in supporting healthy, diverse and connected natural environments?	See <b>Table 5</b>	See <b>Table 5</b>	See <b>Table 5</b>
d. What progress has been made in supporting coordinated, collaborative and innovative leadership in pest animal biosecurity?	See <b>Table 5</b>	See <b>Table 5</b>	See <b>Table 5</b>
e. Have there been any unexpected outcomes?	Insights from LLS/RPAC members and other stakeholders	LLS/RPAC discussion and consider standardised stakeholder survey (developed in consultation with DPI)	LLS/RPACs - Annually



**Table 5:** Indicators and methods for monitoring, evaluating and reporting on progress towards key outcomes of RSPAMPs. **Table 6** outlines how these methods will need to be applied in each of the regions to ensure consistency.

Goal	Key outcome	Indicator(s) (priority indicators identified in bold)	Data source and method (more details on methods in Error! Reference source not found.)
1	<b>Increased involvement of stakeholders in decision-making</b>	<ul style="list-style-type: none"> <li># RPAC meetings and attendance</li> <li>perceptions of RPAC members</li> </ul>	<ul style="list-style-type: none"> <li>RPAC documents/records</li> <li>survey of RPAC members</li> </ul>
1	<b>Pest animal threats are continually identified, assessed and prioritised</b>	<ul style="list-style-type: none"> <li>time between re-consideration by RPACs of pest animal threats</li> </ul>	<ul style="list-style-type: none"> <li>RPAC documents/records</li> </ul>
1	<b>Cross-tenure partnerships established</b>	<ul style="list-style-type: none"> <li><b># partnerships</b></li> <li>nature of partnership</li> </ul>	<ul style="list-style-type: none"> <li>RPAC documents/records and survey of regional pest animal coordinators</li> </ul>
1	<b>Improved cross-tenure integration and coordination</b>	<ul style="list-style-type: none"> <li><b>perceptions of RPAC members of cross-tenure integration</b></li> <li>level of alignment between RSPAMPs and pest animal priorities identified by other land managers</li> </ul>	<ul style="list-style-type: none"> <li>survey of RPAC members</li> <li>review of RSPAMPs and other public land managers' plans (for selected cases/regions)</li> </ul>
1	<b>Regional investment is better coordinated</b>	<ul style="list-style-type: none"> <li>perceptions of RPAC members of regional investment</li> <li>\$ spent on priority species versus \$ spent on other species</li> </ul>	<ul style="list-style-type: none"> <li>survey of RPAC members</li> <li>review of RSPAMPs and other public land managers' documents (for selected cases/regions)</li> </ul>
1	<b>Increased availability of pest animal data</b>	<ul style="list-style-type: none"> <li># new records in FARMS/BCM system</li> <li><b>% RPACs using data to inform management</b></li> <li>RPAC members' reported systematic recording and use of pest animal monitoring data</li> </ul>	<ul style="list-style-type: none"> <li>FARMS/BCM system records</li> <li>survey of RPAC members</li> </ul>
1	<b>Improved understanding of what works and why in controlling pest animals</b>	<ul style="list-style-type: none"> <li>perceptions of RPAC members</li> <li>perceptions of regional pest animal coordinators</li> </ul>	<ul style="list-style-type: none"> <li>survey of RPAC members</li> <li>survey of regional pest animal coordinators</li> </ul>
1	<b>More and better tools and systems for managing pest animals</b>	<ul style="list-style-type: none"> <li>examples of new tools/systems/processes</li> </ul>	<ul style="list-style-type: none"> <li>RPAC documents/records</li> </ul>

Goal	Key outcome	Indicator(s) (priority indicators identified in bold)	Data source and method (more details on methods in Error! Reference source not found.)
1	<b>Land managers and other duty holders better understand obligations and regional priorities</b>	<ul style="list-style-type: none"> <li>• <b>land managers' (private) understanding of obligations</b></li> <li>• <b>land managers' (private) understanding of regional priorities and their perceptions of clarity of priorities</b></li> <li>• # training/education programs</li> <li>• # participants in training/education programs</li> <li>• reach of broad scale awareness-raising campaigns</li> </ul>	<ul style="list-style-type: none"> <li>• survey of participants in selected extension/training programs (regional)</li> <li>• state-wide/regional survey of all private land managers (tracked through time)</li> <li>• state-wide survey of public land managers (implemented through RPACs)</li> <li>• program/project records</li> </ul>
1	<b>Land managers have increased knowledge and skills in best practice pest animal management</b>	<ul style="list-style-type: none"> <li>• <b>land managers' (private) reported knowledge and skills in best practice pest animal management</b></li> <li>• # extension events/programs</li> <li>• # participants in extension events/programs</li> </ul>	<ul style="list-style-type: none"> <li>• survey of participants in selected extension/training programs (regional)</li> <li>• FARMS/Biosecurity Case Management system</li> </ul>
1	<b>More stakeholders complying with obligations</b>	<ul style="list-style-type: none"> <li>• <b>% of inspections resulting in breaches</b></li> <li>• land managers' (private) self-reported compliance with obligations</li> <li>• land managers' (private) attitudes towards compliance (favourable/unfavourable)</li> <li>• feedback/observations of pest animal officers</li> </ul>	<ul style="list-style-type: none"> <li>• inspection and compliance records (FARMS/BCM system)</li> <li>• state-wide/regional survey of private land managers (tracked through time)</li> <li>• survey of pest animal management coordinators</li> </ul>
1	<b>More stakeholders engaging in best practice pest animal management</b>	<ul style="list-style-type: none"> <li>• <b>% landholders engaged in best practice pest animal management</b></li> <li>• land managers' (private) self-reported use of best-practice</li> <li>• evidence from outcomes related to understanding of obligations, knowledge and skills, attitudes to compliance</li> </ul>	<ul style="list-style-type: none"> <li>• survey of pest animal management coordinators</li> <li>• state-wide/regional survey of private land managers (tracked through time)</li> </ul>
2	<b>Introduction of new pest animals prevented</b>	<ul style="list-style-type: none"> <li>• <b># detections of pest animal species in high risk/other pathways</b></li> <li>• <b>% detections eliminated</b></li> <li>• # inspections (by property size/risk)</li> </ul>	<ul style="list-style-type: none"> <li>• inspection records (FARMS/BCM system)</li> <li>• potential case study of reduced impacts on primary production/biodiversity (see below)</li> </ul>

2/3	Better planning and coordination in relation to new pest animal incursions	<ul style="list-style-type: none"> <li>• <b>% of high priority species with rapid response plans</b></li> <li>• <b>regional pest animal coordinator perceptions of changes to planning and coordination in relation to new pest animal incursions</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>RPAC documents</b></li> <li>• <b>survey of regional pest animal coordinators</b></li> </ul>
3	<b>Earlier/more effective intervention for pest animals</b>	<ul style="list-style-type: none"> <li>• # inspections (by property size/risk)</li> <li>• high risk sites/pathways area inspected (ha)</li> <li>• size of infestation (decrease through time)</li> <li>• <b>% of new incursions (by high priority species) eradicated/managed (as identified by regional pest animal coordinators)</b></li> </ul>	<ul style="list-style-type: none"> <li>• inspection records (FARMS/BCM system)</li> <li>• potential case study of reduced impacts on primary production/biodiversity (see below)</li> <li>• incursions and eradications identified by regional pest animal coordinators/RPACs</li> </ul>
4	<b>Active management of high priority and widespread pest animals that threaten key assets</b>	<ul style="list-style-type: none"> <li>• <b>case study examples as below</b></li> <li>• # ha of reduction in extent/density of priority species</li> </ul>	<ul style="list-style-type: none"> <li>• linked in with case study of reduced impacts on primary production/biodiversity (see below)</li> <li>• RPAC documents/records</li> </ul>
4	<b>Improved protection of high priority assets, inc. Aboriginal cultural heritage sites</b>	<ul style="list-style-type: none"> <li>• <b># key assets being managed</b></li> <li>• <b>% reduction in area of weeds surrounding high priority assets</b></li> </ul>	<ul style="list-style-type: none"> <li>• RPAC documents/records</li> </ul>
4	<b>Pest animal impacts on primary industries are reduced or avoided</b>	<ul style="list-style-type: none"> <li>• # ha of reduction in extent/density of priority species</li> <li>• <b>case study example of reduction/avoidance of impact, including avoided impacts on production, decreased costs of control, etc.</b></li> <li>• \$ spent on pest animal control (through time)</li> <li>• time/hours on pest animal control (through time)</li> <li>• subjective rating of extent and impacts of pest animals by agricultural land managers</li> </ul>	<ul style="list-style-type: none"> <li>• RPAC documents/records</li> <li>• case study selected and specifically assessed (potentially linked to outcomes around early detection/prevention of introduction)</li> <li>• ABARES pest and weed survey results: through time and as compared to land manager survey (above)</li> </ul>
4	<b>Pest animal risks to biodiversity and landscape health are mitigated</b>	<ul style="list-style-type: none"> <li>• <b>case study example of reduction/avoidance of impact, (including improvement in diversity or abundance of native species etc.)</b></li> </ul>	<ul style="list-style-type: none"> <li>• RPAC documents/records</li> <li>• case study selected and specifically assessed (potentially linked to outcomes around early detection/prevention of introduction)</li> </ul>

**Table 6:** Details of methods for monitoring and evaluating the key outcomes listed in **Table 5**, providing general comments on how these methods should be standardised across regions/NSW and the responsibility and timing of implementation. Priority methods are bolded.

Method	To collect information on (at minimum)	Comments on implementation and analysis	Responsibility and timing
<b>Survey of participants in extension/training programs (aim for one per regional program minimum)</b>	<ul style="list-style-type: none"> <li>land managers' understanding of obligations</li> <li>land managers' understanding of regional priorities and their perceptions of clarity of priorities</li> <li>land managers' reported knowledge and skills in best practice weed management</li> </ul> <p>Will be complemented with output data on # programs, # attendees</p>	<p>RPACs to pick a key extension/training program that they have invested in. Survey of participants to gauge efficacy of intervention.</p> <p>Standard survey questions to be provided state-wide, though additional, region-specific questions could be added. Questions to address improvements/changes in key indicators.</p> <p>Focus is on efficacy of training/extension program as an example of capability building.</p> <p>Potential for survey to be done on multiple extension/training programs depending on regional resources.</p>	<p>RPACs</p> <p>Standard survey questions and approach to be designed by DPI in collaboration with RPACs and LLS.</p>
<b>State-wide/regional survey of private land managers</b>	<ul style="list-style-type: none"> <li>land managers' understanding of obligations</li> <li>land managers' understanding of regional priorities and their perceptions of clarity of priorities</li> <li>land managers' self-reported compliance with obligations</li> <li>land managers' attitudes towards compliance (favourable/unfavourable)</li> <li>land managers' self-reported use of best-practice</li> <li>\$ spent on pest animal control (as comparison to ABARES pests and weed management survey)</li> <li>perceptions related to extent and impacts of pest animals (as comparison to ABARES pest and weed management survey)</li> </ul>	<p>Aim is to assess broader impacts of awareness rising on understanding and acceptance of pest animal management obligations.</p> <p>To be a standard survey implemented across all or a sample of regions (depending on resourcing).</p> <p>Indicators to be assessed through time (baseline to be collected as early as possible). Questions to align, where possible, to existing surveys (e.g. see LLS stakeholder surveys, DPI attitudinal survey and ABARES pest animal and weed management survey).</p>	<p>To be implemented by DPI. Initial survey ideally done as soon as possible, with follow up survey done towards the end of the RSPAMPs life.</p>

Method	To collect information on (at minimum)	Comments on implementation and analysis	Responsibility and timing
		<p>More detailed planning is required for this survey, noting key considerations in its design include:</p> <ul style="list-style-type: none"> <li>• sample size and representativity across regions (including the potential to not survey all 11 regions in favour of a higher sample size within regions)</li> <li>• potential for comparison between sub-regions that have had extension programs versus those that have not (requiring collaboration between DPI and RPACs)</li> <li>• potential to form the basis of a long-term monitoring dataset</li> <li>• survey design to prioritise high levels of completion/reliability in targeted questions rather than data breadth (i.e. shorter, more succinct questioning)</li> </ul>	
<p><b>Review of RPAC/LLS records</b></p>	<ul style="list-style-type: none"> <li>• # training/education programs</li> <li>• # participants in training/education programs</li> <li>• reach of broad scale awareness-raising campaigns</li> <li>• refined pest animal distribution and density maps at local and regional scales</li> <li>• % of high priority species with rapid response plans</li> <li>• # ha of control of high priority species</li> <li>• asset protection – nature of asset, area of management, impact reduction</li> <li>• # RPAC meetings and attendance</li> <li>• # partnerships</li> <li>• nature of partnership</li> </ul>	<p>Key metrics to be recorded as part of program delivery. Will contribute to understanding the scope and scale of many of the activities under the RSPAMPs and will closely link to a range of key outcomes, acknowledging that the indicators themselves will not be used in isolation/without discussion of context.</p> <p>RPAC records re: mapping and action on pest animal infestations may need to sample cases of control to provide information on % reduction in pest animal abundance.</p> <p>It may be possible for DPI to more closely examine of partnerships in a sample of regions, exploring changes in the number and strength of partnerships/relationships using social network analysis.</p>	<p>Data collection by RPACs/LLS/regional pest animal coordinators - Ongoing.</p> <p>DPI to consider closer examination of partnerships (e.g. using social network analysis) in a sample of regions – would ideally use a before/after survey; first survey early in life of the RSPAMP and follow-up towards the end of the RSPAMP.</p>

Method	To collect information on (at minimum)	Comments on implementation and analysis	Responsibility and timing
<b>Review of FARMS/BCM system data</b>	<ul style="list-style-type: none"> <li>• % of inspections with breaches</li> <li>• # inspections</li> <li>• # inspections (by property size/risk)</li> <li>• area inspected (ha)</li> <li>• size of infestation (decrease through time)</li> <li>• # detections of pest animal species in high risk/other pathways</li> <li>• % detections eliminated</li> </ul>	<p>Key metrics to be recorded as part of program delivery. Will contribute to understanding the scope and scale of many of the activities under the RSPAMPs and will closely link to a range of key outcomes, acknowledging that the indicators themselves will not be used in isolation/without discussion of context.</p>	Biosecurity officers - Ongoing.
<b>Survey of biosecurity officers</b>	<ul style="list-style-type: none"> <li>• feedback/observations of biosecurity officers re: landholder compliance</li> <li>• feedback/observations of biosecurity officers re: landholder use of best practice (estimates of % engaged in best practice and changes over time)</li> <li>• estimates of new incursions identified</li> <li>• estimates/judgements of eradications of new incursions</li> </ul>	<p>To supplement information in FARMS/BCM and to provide a qualitative perspective and understanding of the data.</p> <p>Ideally, biosecurity officers would maintain records of:</p> <ul style="list-style-type: none"> <li>• the % of landholders they visit that are engaged in best practice pest animal management (either based on a sample or more comprehensive monitoring where possible)</li> <li>• new incursions</li> <li>• eradications.</li> </ul>	<p>To be implemented by RPACs.</p> <p>Standard survey questions and approach to be designed by DPI in collaboration with RPACs.</p> <p>First survey early in life of the RSPAMP and follow-up towards the end of the RSPAMP.</p>
<b>Case study on reduction of impacts/benefits for primary production</b>	<ul style="list-style-type: none"> <li>• data collection will depend on case study focus, but may include: <ul style="list-style-type: none"> <li>➢ changes in expenditure/time on pest animal control</li> <li>➢ changes in productivity (including land use change to avoid pest impacts).</li> </ul> </li> </ul>	<p>The aim of the case study would be to demonstrate the impacts of pest animal control or prevention on the profitability, productivity or sustainability of primary industries.</p> <p>Regions are in the best position to identify potential candidate case studies, while DPI/SPAC would be able to provide input on getting a balance and variety of case study types.</p> <p>Across the state, there is likely to be a mix of qualitative case studies, as well as those supported by more detailed economic modelling/assessment. These particular cases could be identified by DPI/SPAC.</p>	<p>DPI to explore and develop a standardised economic modelling approach that could be implemented in select cases by regions (potentially with additional state support). In developing guidelines for an appropriate method, it will also be important to consider:</p> <ul style="list-style-type: none"> <li>• likely costs of implementing the selected method</li> <li>• the likelihood that sufficient data will be available for model</li> </ul>

Method	To collect information on (at minimum)	Comments on implementation and analysis	Responsibility and timing
		<p>Standardised methods for economic analysis to be developed as a guide for regions. Cost-benefit analysis based on bioeconomic modelling is likely to be the most broadly applicable method that would lead to aggregable results, including:</p> <ul style="list-style-type: none"> <li>• lost production value (\$)</li> <li>• control costs voluntarily incurred (\$).</li> </ul>	<p>parameterisation (including biological and financial data)</p> <ul style="list-style-type: none"> <li>• the availability of sufficient expertise and time for the analysis.</li> </ul> <p>RPACs and regional pest animal coordinators would identify and agree on potential case studies with DPI/SPAC.</p> <p>DPI/SPAC to select examples across the state for more detailed quantitative/economic assessment. All other case studies to be developed by RPACs.</p> <p>Case studies to be completed by the end of RSPAMP term.</p>
<b>Case study on reduction of impacts/benefits for environmental values</b>	<ul style="list-style-type: none"> <li>• data collection will depend on case study focus, but may include: <ul style="list-style-type: none"> <li>➢ changes in abundance of native species</li> <li>➢ impacts on threatened species or work on threat abatement plans</li> <li>➢ ecological benefits with respect to connectivity</li> <li>➢ changes in site-level species diversity or similar</li> </ul> </li> </ul>	<p>The aim of the case study would be to demonstrate the impacts of pest animal control on the health, diversity and connectedness of natural environments.</p> <p>Regions are in the best position to identify potential candidate case studies, while DPI/SPAC would be able to provide input on getting a balance and variety of case study types.</p> <p>Across the state, there is likely to be a mix of qualitative case studies. There may also be examples that are suited to more detailed assessment (e.g. using biodiversity surveys). These particular cases could be identified by DPI/SPAC and supported accordingly.</p>	<p>DPI to explore and develop suggested methods that may be implementable in select cases (e.g. monitoring of indicator species).</p> <p>RPACs and regional pest animal coordinators would identify and agree on potential case studies with DPI/SPAC.</p> <p>DPI/SPAC to select examples across the state for more detailed assessment. All other case studies to be developed by RPACs.</p> <p>Case studies to be completed by the end of RSPAMP term.</p>
Survey of regional pest animal coordinators	<ul style="list-style-type: none"> <li>• estimates of new incursions identified</li> <li>• estimates/judgements of eradications of new incursions</li> </ul>	To provide overview of key issues/achievements and to aid in understanding context	Standard survey questions and approach to be designed by DPI in collaboration with RPACs.

Method	To collect information on (at minimum)	Comments on implementation and analysis	Responsibility and timing
	<ul style="list-style-type: none"> <li>• perceptions of changes to planning and coordination in relation to new incursions</li> <li>• perceptions re: cross-tenure integration</li> <li>• perceptions re: function of RPAC in continually identifying, assessing and prioritising pest animal threats</li> <li>• perceptions re: improvement in coordination of regional investment</li> <li>• examples of new tools/ systems/ processes</li> </ul>		First survey early in life of the RSPAMP and follow-up towards the end of the RSPAMP.
Survey of RPAC members	<ul style="list-style-type: none"> <li>• perceptions re: involvement of stakeholders in decision-making</li> <li>• perceptions re: function of RPAC in continually identifying, assessing and prioritising pest animal threats</li> <li>• perceptions re: cross-tenure integration</li> <li>• perceptions re: improvement in coordination of regional investment</li> </ul>	To gauge satisfaction of members with the way those different groups have been represented and the overall function of the committees. This could potentially provide a useful, high-level summary of the function of groups in different areas.	To be designed and implemented by DPI.  First survey early in life of the RSPAMP and follow-up towards the end of the RSPAMP.
Comparison of RSPAMP documentation and other public land manager documentation	<ul style="list-style-type: none"> <li>• level of alignment between RSPAMPs and pest animal priorities identified by other land managers</li> <li>• \$ spent on priority species versus \$ spent on other species</li> </ul>	Analysis of alignment between RSPAMP priorities and other public land managers' priorities could be done for a sample of regions. <ul style="list-style-type: none"> <li>• The analysis of \$ spent on priority species versus other species would likely only be done for a sample of regions where data is available. Of interest is whether the amount being spent on priority species (i.e. in line with the RSPAMP) is increasing.</li> </ul>	DPI to assess sample of alignment of RSPAMP and other public land manager priorities. To be done for final RSPAMP report.
Analysis of ABARES data	<ul style="list-style-type: none"> <li>• \$ spent on pest animal control (through time)</li> <li>• time/hours on pest animal control (through time)</li> <li>• subjective rating of extent and impacts of pest animal by agricultural land managers</li> </ul>	Data to be accessed from ABARES, including exploration of whether level of sampling can be improved for regional-level analysis. Comparison with DPI-led survey (above) is also possible. Changes in indicators will need to be assessed in the context of other results to understand the broader picture of impact in each region.	DPI to coordinate with ABARES



**Table 7: Statewide core metrics for pest animal management in NSW**

**Established pest animals** – focus should be on governance, planning and capacity to manage pest animals in a strategic and coordinated way. A key measure of this is *active local pest animal management plans* and the metrics to be reported **by LLS** for *each* plan are:

- >species
- >area (ha or sq.km.)
- >number of landholders and their enterprise/tenure
- >number of organisations involved in the collaborative design and delivery of these local plans.

Data on the above can be collated at the State level and presented in table and/or map form for each species. These maps can then be compared to statewide species distribution/relative abundance maps to help identify priority management areas that don't have active management groups and plans in place.

**New incursions – DPI** to maintain data on:

- >species
- >number of reports
- >follow-up activities
- >evidence of establishment.

**Capacity** – quantified measures are:

- >number of landholders with a current vertebrate pesticide training qualification (**LLS** data)
- >number of Authorised Control Officers (can be obtained via **Vertebrate Pesticide Training Group**).

**Compliance activities** –activities recorded by Authorised Officers against each stage of the General Biosecurity Duty procedure:

- >Record and triage notification/report of pest animal problem
- >Collect background information
- >Education
- >Investigation/property visit
- >Compliance (e.g. issuing Biosecurity Direction)
- >Re-inspection
- >Intervention (e.g. possible Court action)

Graphing statistics on the above will provide an indication of Biosecurity Act education activity and levels of voluntary vs involuntary compliance. Regional comparisons can be drawn as well as trends over time.

## 6 Reporting and governance

LLS/regional pest animal coordinators will prepare an annual report on RSPAMP progress for respective RPACs and LLS Boards. The report will focus on: progress against RSPAMP KPIs (which may be reviewed following publishing of this MERI framework); lessons to aid continual improvement; and case studies of impact.

LLS will summarise regional reports, including compilation of core statewide metrics (**Table 7**), for presentation to SPAC annually.

RSPAMPs will be formally evaluated in the middle (2021) and at the end (2023) of their terms. SPAC will provide input to this evaluation process.

## Appendix A – NSW pest animal distribution and relative abundance mapping

Pest animal distribution and relative abundance mapping is fundamental to planning pest animal management programs and measuring their effectiveness over time. The NSW statewide pest animal mapping process is based on expert opinion (generally from government staff who regularly consult with public and private land managers) against the below relative abundance categories. This approach is considered to be more realistic than trying to define precise pest animal density estimates, which can only be obtained through formal survey work, which is expensive and therefore such data is rarely available.

### RELATIVE ABUNDANCE CATEGORIES

<b>High (abundant)</b>	<b>Many animals seen at any time and much sign of activity.</b> Animals always observed and reliable sightings or sign. Significant sign of animals on <b>more than 80%</b> of occasions.
<b>Medium (common)</b>	<b>Some</b> animals seen at almost any time / Much active sign / Frequent but unreliable sightings of animals. Significant sign of animals on <b>50-80%</b> of occasions.
<b>Low (occasional)</b>	<b>Few</b> or no sightings, little active sign. Very little sign of animals on <b>1-50%</b> of occasions.
<b>Absent</b>	<b>No animals</b> - No sign of animals, or animals have been removed from this location.
<b>Unknown</b>	Unsure, no information to base your judgement.
<b>Present, but abundance unknown</b>	Species is present, but abundance is unknown
<b>Deer present, but species is unknown</b>	Deer present, but the species is unknown (there are six wild deer species in NSW)

## Appendix B – Potential impacts of vertebrate pests

The below list of potential vertebrate pest impacts should be considered in determining the overall threat posed by a particular species in a particular area and therefore the priority for management (*adapted from Bomford, M. 2003. Risk Assessment for the Import and Keeping of Exotic Vertebrates in Australia. Bureau of Rural Sciences, Canberra.*)

### ***(i) Reduced agriculture/forestry/aquaculture productivity***

- *Crop losses*
- *Stored produce losses*
- *Forestry losses*
- *Competition with livestock for pasture, browse and water*
- *Losses to intensive livestock and poultry facilities*
- *Predation and harassment of stock*
- *Land and water degradation*
- *Flow-on effects to other industries (e.g. transport and processing of primary production)*

### ***(ii) Environmental damage***

- *Predation and harassment of native fauna*
- *Competition with or disturbance of native fauna*
- *Grazing and browsing on native plants*
- *Secondary flow-on effects in ecological communities (changes in community structure and food webs)*
- *Hybridising with native species and other genetic effects*

### ***(iii) Potential as agents in the spread of parasites or diseases***

### ***(iv) Social nuisance (including public amenity) and injury risks to people***

### ***(v) Impact on Aboriginal cultural sites (e.g. significant waterholes) and amenity (e.g. ability to harvest bush tucker)***

### ***(vi) Infrastructure damage (buildings, equipment, fences etc)***

### ***(vii) Damage and costs of pest control measures***

## Appendix C – Example of detailed metrics that could be collected for a particular pest animal species

The below table provides a list of metrics associated for wild dog management that could be adapted to other pest animal species to measure impact, management, planning and compliance.

Outcome/output	Metric	necessary data
<b>Economic Assessment</b> (change/ trends)	livestock attacked/ <b>space</b> /time	no. attack events
	livestock killed/ space/time	livestock kill no.s
	livestock mauled/ space/time	livestock mauled (& survived) no.s
	pets attacked/ space/time	pets mauled (& destroyed) no.s
	pets killed/ space/time	pets mauled (& destroyed) no.s
	pets destroyed/ space/time	pets mauled (& destroyed) no.s
	livestock attacked/ <b>exposed</b> /time	no. attack events
	livestock killed/exposed/time	livestock kill no.s
	livestock mauled/exposed/time	livestock mauled (& survived) no.s
	livestock destroyed/exposed/time	livestock mauled (& destroyed) no.s
	pets attacked/ <b>exposed</b> /time	no. attack events
	pets killed/exposed/time	pets kill no.s
	pets mauled/exposed/time	pets mauled (& survived) no.s
	pets destroyed/exposed/time	pets mauled (& destroyed) no.s
<b>Population index</b> (change/ trends)	dogs seen/ space/ time	no. dogs seen
	dogs killed/space/time	no. dogs killed at point of control or found dead after poisoning
<b>Control effort &amp; efficiency</b>		
baiting	baits laid/ space/time	no. baits laid
	baits taken/ space/time	no. baits taken
trapping	traps set/ space/time	no. traps set
	trap captures/ space/time	no. trapped dogs
CPE's	CPE's set/space/time	no. set
	CPE's activated/space/time	no. activated compared to unactivated/reset
fencing	km maintained/ space/time	km new dog proof fence
	km constructed/ space/time	km dog proof fence maintained
LGAs	LGA / space/time	no. dogs, llamas, donkeys etc.
	LGA / exposed/time	no. dogs, llamas, donkeys etc.
shot, run over, gassed, etc.	dogs killed/space/time	no. dogs shot, etc.
<b>Plans</b>		
	Active plans	no. plans active per Regional/Reserve Boundary control activities
	Active plans	control activities on areas not covered by a plan
	Non plan activities	no. of active programs/space/time
	Active Group programs	control activities
	Active Group programs	
<b>Compliance</b>		
	Total expenditure	actual costs expended per plan/program
	Total control area	the area subject to control
	AO Inspections	no. inspection reports
	AO Followups	no. inspection followup reports
	Pesticides issued	no. authorisations for use