NSW GOVERNMENT | Natural Resources Commission

Weeds – Time to get serious

Review of weed management in NSW
Draft report

February 2014

Enquiries

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List of acronyms

APVMA	Australian Pesticides and Veterinary Medicines Authority
CAP	Catchment Action Plan
CMA	Catchment Management Authority
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cwlth	Commonwealth
DPI	Department of Primary Industries (NSW)
FTE	Full Time Equivalent
IGAB	Intergovernmental Agreement on Biosecurity
IPART	Independent Pricing and Regulatory Tribunal
LCA	Local Control Authority
LHPA	Livestock Health and Pest Authorities
LLS	Local Land Services
NEBRA	National Environmental Biosecurity Response Agreement
NPWS	National Parks and Wildlife Service
NWAC	Noxious Weeds Advisory Committee
NRC	Natural Resources Commission
NSW	New South Wales
OEH	Office of Environment and Heritage (NSW)
RDC	Research and Development Corporation
RWAC	Regional Weeds Advisory Committee
WAP	Weeds Action Program
WoNS	Weeds of National Significance

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1 Executive summary

The Minister for Primary Industries asked the Natural Resources Commission (NRC) to undertake an independent evaluation of the effectiveness and efficiency of weed management arrangements in NSW, given the significant impacts of weeds on the NSW economy and environment. One purpose of this review is to inform the development of the proposed NSW Biosecurity Act, and other relevant strategies including the NSW Biosecurity Strategy. This report sets out the NRC's preliminary findings and recommendations.

The NRC is seeking public feedback on this draft report until 6 April 2014. The NRC will continue to consult with stakeholders and review public feedback to inform the final recommendations.

Best available data indicates that the distribution and impact of weeds in NSW continue to grow, despite the significant ongoing efforts of landholders, weed management staff and volunteers. Distribution mapping of weeds in NSW is inconsistent, making it difficult to get a complete picture of how weed density and extent are changing across the state. There is insufficient data to track the outcomes of most weed management efforts, or effectively plan where and how to best target investment in weed management.

What is clear is that weeds have a significant impact on environmental, economic and social well-being in NSW. An Australian Bureau of Statistics survey conducted in 2006-2007 indicates NSW agricultural businesses incurred an estimated annual cost of $475 million in managing weeds, as well as considerable additional costs from lost productivity and labour for weed management.

Weeds threaten around 45 per cent of NSW threatened biodiversity.[1] Several weeds are consequently listed as key threatening processes under both the NSW *Threatened Species Conservation Act 1995*[2] and the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).[3]

Incursions that are not effectively controlled ultimately become widespread weeds, with substantial ongoing costs borne by landholders. Strong monitoring programs are critical to allow for identification of incursions as quickly as possible, as prevention and eradication are far more cost effective than management of weeds once they become widespread.[4]

Overall, the NRC found that the effectiveness of weed management arrangements varies across NSW. There are significant opportunities to simplify often complex or duplicative planning, delivery and funding arrangements to improve efficiency and ultimately deliver better outcomes. These findings are explained in detail in **Chapters 4-6**.

1 Coutts–Smith, A.J. and Downey, P.O. (2006), *Impact of weeds on threatened biodiversity in New South Wales*, Technical Series no. 11, CRC for Australian Weed Management, Adelaide.

2 Details of the 37 key threatening processes listed under the NSW *Threatened Species Conservation Act 1995* (NSW) can be found at environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm (accessed 2 December 2013).

3 Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants, is listed as a key threatening process under the *Environment, Protection and Biodiversity Conservation Act 1999* (Cwlth).

4 The NSW Biosecurity Strategy indicates an indicative return on investment of 1:100 for prevention and 1:25 for eradication.

Many of the NRC's findings are consistent with those of previous reviews, including the most recent review of the *Noxious Weeds Act 1993*. Several suggestions from that review were deferred for future consideration, but remain critical issues that must be addressed to achieve more effective outcomes across the landscape. Strong leadership and improved accountability are now required to make the necessary changes, many of which have been supported by stakeholders for some time.

Ultimately, it is the action and cooperation of people that will deliver improved weed management. Real change must occur at all levels to more effectively tackle weeds, through building capacity and working together towards integrated and sustained land management practices. The good news is that there is a wealth of committed, passionate people at all scales in the public, private, and community sectors, eager to improve weed management outcomes.

The development of the Biosecurity Strategy, NSW Biosecurity Act, and new regional arrangements for Local Land Services (LLS), provide opportunities to better integrate weed management with broader biosecurity and natural resource management initiatives, aiming for environmental, social and economic outcomes. The NRC's proposed alternative arrangements aim to build on what already exists to support Local Control Authorities[5] (LCAs) to do what they do best, while creating more effective regional and state governance structures that will improve strategic planning, governance, knowledge transfer and accountability. The recommendations outlined below are explained in detail in **Chapter 7**.

Prevention, eradication and management of widespread weeds

The NRC recommends that new arrangements more clearly delineate two aspects of weed management – prevention and eradication of incursions, and management of widespread weeds. Containment will continue to be an important strategy for achieving both of these aims. Widespread weeds should be managed at the local and regional scale, and the NSW Government should have primary accountability for prevention, detection and eradication of incursions. There should be clear triggers for transfer of management responsibility when the eradication of a species is deemed unfeasible.

The persistence of a wide range of weed species shows the need for a broad range of policy responses. A regulatory approach should be but one tool supported by other strategies focused on cooperative community action and a whole-of-landscape approach, particularly for widespread weeds.[6] Widespread weed management should have a greater focus on the social aspects of landscape management.

[5] LCAs have a responsibility under the *Noxious Weeds Act 1993* (NSW) for surveillance and enforcement on private lands as well as control of noxious weeds on their own lands. LCAs are by default local councils, but a local council may designate another authority to carry out their duties. LCAs currently include single councils, county councils and weed authorities.

[6] Thorpe, J. & Lynch, R., (1999) *The impact of the national weeds strategy on weed management within Australia,* proceedings of the Twelfth Australian Weeds Conference, Hobart, available at: caws.org.au/awc_contents.php?yr=1999.

Tenure-neutral approach

Moving to a tenure-neutral approach, where all land managers have equivalent, reasonable obligations regardless of tenure, is critical to improving outcomes. However, it is not feasible, or in some cases desirable, to simply apply the current regulatory arrangements across all tenures. Reasonable requirements should be established, with all landholders then held accountable for agreed obligations. All landholders must be required to act on high priority new or emerging weeds (currently classes 1-3). However, for widespread weeds there is a need to recognise the varied management objectives of different land managers, and allow priorities and obligations to be negotiated with the community on a regional basis.

Strengthening response to new incursions

State-wide coordination and timely access to funds are needed to improve NSW's response to new incursions. Implementing response measures for new weed incursions with the same rigour as for other biosecurity threats, such as animal diseases, should ensure that threats are quickly assessed and that response is timely. It will also create efficiency by leveraging existing biosecurity response systems and funding mechanisms. In addition to current funding, a state-level reserve fund for responding to new high-risk incursions should be established. The response fund should be modelled after the pest insect destruction fund and raised through a levy on LLS rate payers, with the state providing additional funds when necessary.

If an incursion has passed a defined time period for initial response, but the weed is still considered eradicable, an eradication plan should be developed by the Department of Primary Industries (DPI) in consultation with stakeholders. Resources for implementing these plans should be negotiated between DPI, relevant LLSs and LCAs, and other relevant stakeholders including industry, based on the area and the values likely to be impacted by the incursion.

The NSW Government should have primary accountability for prevention and eradication outcomes, with surveillance and inspection services continuing to be delivered by LCAs.

Regional coordination and local service delivery for widespread weeds

Widespread weeds should be managed through partnerships at the local and regional scales, guided by strategic regional priorities. Community ownership is the key to effective weed control.

Local service delivery by LCAs is a significant strength of the NSW system, and should be maintained, consistent with the NSW commitment to localism. LCAs provide engagement and capacity building at the local scale, building important relationships with local stakeholders. While there is evidence of inconsistent performance across the state, the NRC has observed the high level of professionalism, commitment and local knowledge of weed officers. Maintaining these local connections is particularly important for facilitating the proposed approach to widespread weed management.

Stakeholders from both private and public land tenures should come together at the regional scale to develop a regional plan that identifies priorities for managing widespread weeds, and how landholders can address these priorities. Implementing this regional plan would then occur at the local and regional scales, with stakeholders aligning their actions and investment to more effectively and efficiently manage priority weeds. The intent of this proposal is to consolidate priorities and replace the wide range of competing regional plans already in place.

The NRC has determined that LLSs are best positioned to ensure development of a regional strategic plan for weed management. LLSs are already responsible for broader regional strategic planning and building partnerships across government and communities to support integrated land management.

The LLS Board should be supported by statutory regional weed committees made up of LCAs, representatives of the full range of public and private landholders and community representatives, similar to the Bushfire Management Committee model. These will be subcommittees within LLS, reporting to the LLS Boards, and aligning with LLS boundaries. Each committee would be responsible for negotiating the regional weed management plans for endorsement by the LLS Board, including prioritising widespread weeds for the region.

The development of the plan should be a collaborative, evidence-based process between the LLSs, regional weed committees and the community. In developing these plans, the committees should draw on best-available local and scientific evidence. NSW's weeds research and development capacity should also be expanded in order to inform and improve strategic decision-making and on-ground outcomes. Importantly, these committees provide opportunities for the community to be more directly involved in weed management and planning.

Surveillance and monitoring, as well as education and capacity-building, are currently jointly funded by the NSW Government and LCAs. These joint arrangements should be formalised to clarify contributions, ensure greater consistency and improve accountability. Allocation of Weed Action Program (WAP) funding should be based on an up-to-date assessment of risk, need and performance. NSW should advocate for the Australian Government and others to consider the regional plans when providing funding for weed management projects. LLSs may also raise levies for management of specific weeds when determined necessary in consultation with the community.

Over time, the partnership between LLSs and LCAs should lead to efficiencies through integrated management of pest plants and animals. This partnership should also support well-resourced and targeted public education activities.

Accountability and performance improvement

Proposed institutional and regulatory changes to weed management will not lead to any change without improved accountability at all levels. In fact, many complaints about the current institutional arrangements are not about the arrangements themselves, but with a lack of accountability for meeting obligations under the arrangements.

Property scale enforcement mechanisms are ineffective due to low penalties, and the cost and time associated with elevating a case to court or undertaking controls. LCAs are often unwilling to undertake compliance for widespread weeds. The NRC recommends changes to the enforcement provisions to address these concerns, as outlined in Table 1.

There is a need for clear performance standards for local service delivery and an auditing function to ensure that performance issues are identified and addressed. New legislation should allow for LCA responsibilities (other than management of their own land and roadsides) to be transferred to the regional LLS if an LCA is not fulfilling its obligations. Fees for these services should be paid by the LCA.

An independent audit at the state level is needed to improve accountability by helping to ensure that strategic planning and funding allocation are risk-based, that outcomes are tracked and achieved, and that auditing of the regional and local service delivery is appropriately carried out.

Improvements to current record-keeping, monitoring and reporting are also needed to improve accountability. The ability to track progress and adapt decision-making to current conditions is essential to address weed incursions and demonstrate performance. Standard metadata protocols should be implemented state-wide, and the state should maintain a system for state-wide data-sharing. Biosecurity NSW should expedite delivery of a data management system to meet this need. Receipt of government funding should be dependent on agreement to use the mandated data protocols.

The proposed roles and responsibilities are summarised in Figure 1 and more detail is provided in **Chapter 7**.

Simplified weed declarations to support management objectives

The NRC recommends that weed declarations be simplified by reducing the number of weed categories to three, in line with the proposed model: weeds prohibited from entering the state, weeds to be eradicated, and weeds to be managed as widespread weeds on a regional basis.

The process for declaring weeds can also provide for a more transparent assessment of economic, environmental and social values. The NRC recommends that the Noxious Weed Advisory Committee be replaced by a new committee (the Ministerial Weed Advisory Committee), and include members with economic, social and technical expertise, as well as stakeholder representatives, to oversee weed declaration recommendations.

A permitted for sale list to improve prevention of new incursions should be established. NSW should adopt a permitted list, through a staged program to be completed within five years. A list of aquatic weeds permitted for sale should be adopted in the first instance. The nursery industry would then propose a full permitted list within 12 months. The Ministerial Weed Advisory Committee would make recommendations on the final list, following public consultation. NSW should also continue to advocate for improved national alignment of weed declarations.

Weed status certification

A key responsibility of LCAs should be to issue weed status certificates for each property greater than one hectare at least every five years. These would cover public and private land and serve multiple purposes including:

- enabling disclosure of weed status on sale of land, or lease of public land
- providing assurance of reliable fodder sources
- formalising regular inspections
- providing an incentive for otherwise disinterested land managers to manage weeds and have inspections
- raising the profile, understanding and importance of weed issues in the community.

More effective risk management

Current regulatory arrangements fail to sufficiently hold risk creators responsible for the potential consequences of the risks they create. While it is not always possible to hold all risk creators fully responsible, there are opportunities to better control several high-risk pathways, including the commercial plant trade, fodder trade and spread of aquatic weeds.

Recommendations for addressing these pathways include:

- new biosecurity legislation should be founded on a 'general biosecurity obligation' that requires all stakeholders to take responsibility for biosecurity
- new rules requiring the registration of entities whose activities generate weed risks, for example, nurseries and fodder distributors, and making it an offence for unregistered entities to carry out these activities. Registration would require certification of acceptable weed status.
- encouraging greater self-management of weed risks by competent parties by providing for the establishment of industry contribution schemes and auditable compliance agreements
- making LLS the responsible authority for controlling declared aquatic weeds within a region.

Current regulatory provisions could be improved by allowing prospective land purchasers to easily identify potential weed issues on the land they are seeking to buy. Sub-divisions are also often undertaken on properties that are subject to weed notices, without proper consideration for maintaining weed control. Finally, leases on public land do not currently require assessment of weed status. Addressing these concerns through weed status certification will improve landholder understanding of their responsibilities and reduce risks created by frequent change in ownership.

Limitations of the minor-use permit process are an obstacle for addressing incursions. The Commonwealth *Agricultural and Veterinary Chemical Code Act 1994*, which regulates herbicide use, requires landholders to obtain a minor use permit for 'off-label' use of a herbicide, which can prevent rapid response to incursions. NSW should advocate improved processes through the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Some LCAs use the same chemical on roadsides repeatedly, increasing risk of resistance and creating risks for neighbours. The NSW Government should develop guidance regarding chemical options and rotation policies. LLSs should ensure that chemical rotation is written into regional programs along with other integrated weed management best practice.

Research and development

NSW Government should commit to prioritised, long-term research funding. This will ensure that regional planning and on-ground solutions are supported by the latest available evidence, and will support innovative and sustainable weed management solutions. Research capacity is declining at both state and national scales. A long-term research strategy is needed to reverse this trend and to continue to deliver improved weed management solutions, including new biological controls. Government should also take steps to ensure research results are readily available and better disseminated to on-ground practitioners.

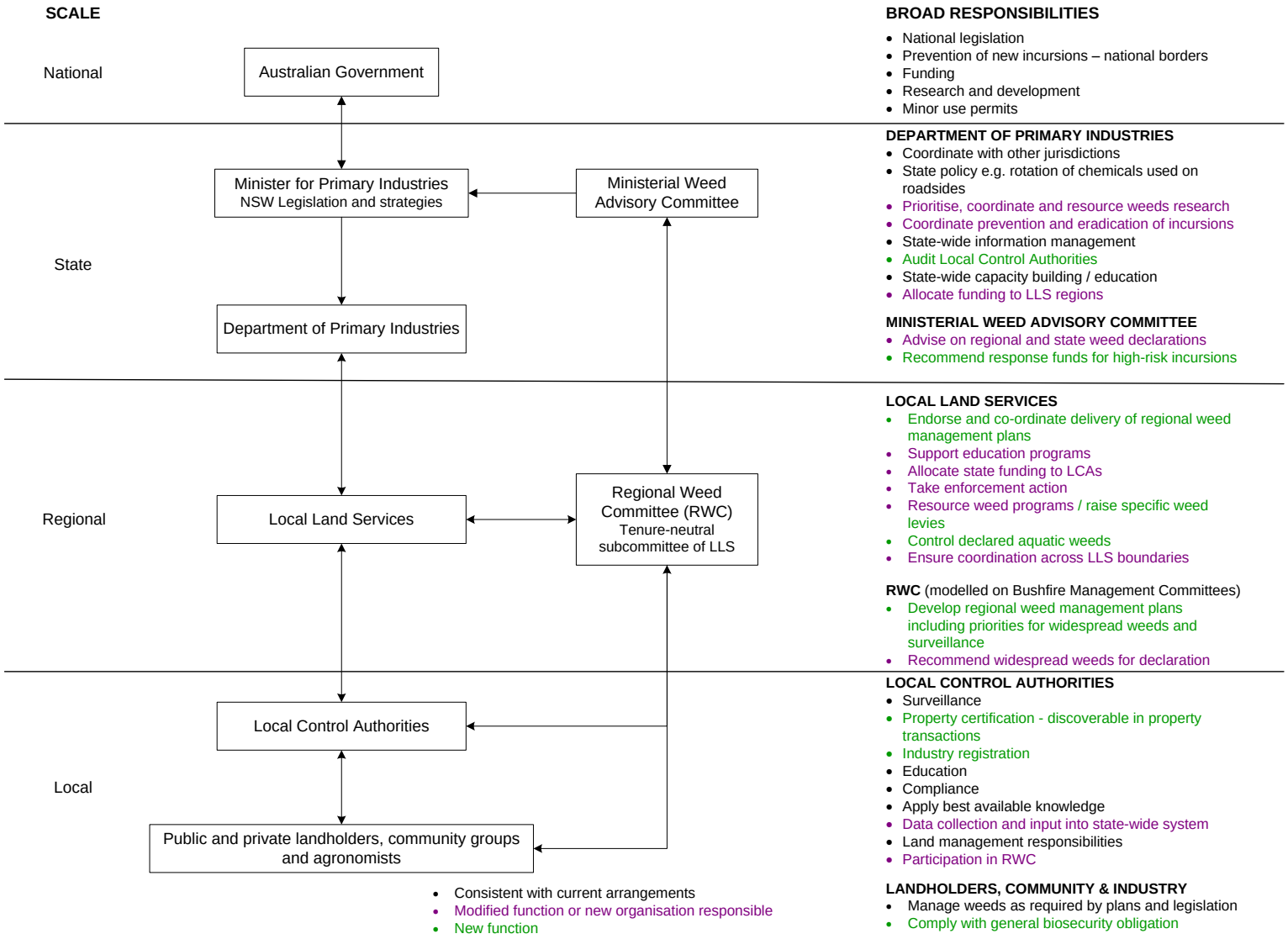

Figure 1: Proposed roles and responsibilities for weed management

Table 1: Summary of draft recommendations

The NRC recommends that:
1 The NSW Government should revise the current model for weed management based on: a. a tenure-neutral approach to integrated weed management within the legislation, requiring all landholders to meet legislative and regionally agreed obligations b. a clear division of responsibilities based on simplified weed categories: - **prevention and eradication** of incursions at the state scale - **management of widespread weeds** at the local and regional scale. Proposed roles and responsibilities at the local, regional and state scales are summarised in **Figure 1**.
2 The NSW Government be accountable for the management of weed incursions including by: a. establishing a reserve fund for responding to new high-risk new incursions (similar to the pest insect destruction fund) b. preparing enforceable weed eradication plans consistent with response plans for other biosecurity responses, with funding arrangements to be negotiated between DPI and LLSs.
3 The NSW Government should simplify and improve the transparency around weed declarations by: a. reducing the number of weed categories to three: weeds prohibited from entering the state, weeds to be eradicated, and weeds to be managed as widespread weeds on a regional basis b. developing a skills and stakeholder representation based Ministerial Weed Advisory Committee which will be responsible for transparent evaluation of weed declarations, based on assessment of potential long-term risks and impacts to the economy, environment and community c. implementing a 'permitted list' for sale of plants within NSW, starting with aquatic plants and transitioning to all species within five years.
4 The NSW Government should support a coordinated regional and localised approach to managing widespread weeds by: a. continuing local level service delivery by LCAs b. developing eleven statutory regional weed committees comprising LCAs, public and private landholders and community members (similar to the Bushfire Management Committee model) as subcommittees to LLS, and aligned with LLS borders c. tasking the regional weed committees with developing regional plans and priorities for widespread weeds and surveillance d. ensuring all regional plans are based on best available local knowledge, research findings and currently available technology and promote innovative approaches to behavioural change and adoption of integrated land management practices e. encouraging state bodies and the Australian Government to align funding with regional priorities identified in these strategic plans.

The NRC recommends that:

5 The NSW Government should improve performance and accountability by:

a. strengthening the enforcement provisions in any new legislation:
   - providing for more substantial penalties, based on the severity and type of the offense
   - assigning responsibility for enforcement action beyond the initial issuance of a weed control notice to LLS, and simplifying the requirements for taking action

b. developing state-wide service-delivery standards for LCAs. DPI should audit LCAs against these standards, with LLS given the ability to assume the LCA's surveillance responsibilities if the LCA cannot meet their obligations. LCAs would not be relieved of responsibilities to manage their own land or roadsides

c. assigning an independent state-level auditor to assess LLS and DPI's performance in weed management, and the extent to which funding has been allocated in line with strategic priorities

d. providing for consistent, state-wide weed mapping including:
   - adopting standard data protocols and record-keeping requirements, which are mandatory for any body receiving government funding for weed management
   - developing and maintaining a state-wide data sharing system for tracking weed distribution and density, which has current data from all LCAs

e. ensuring that data is readily available to stakeholders and regional managers for use in adapting management plans and actions.

6 The NSW Government should improve risk management by:

a. creating a general biosecurity obligation that requires all stakeholders to take all reasonable and practical measures to minimise biosecurity risks

b. establishing a property weed status certification scheme, using the existing surveillance and monitoring programs, which would be disclosed on the sale of land and provided to parties who lease public land.

c. requiring the registration of commercial entities whose activities generate weed risks, for example nurseries and fodder distributors, and making it an offence for un-registered entities to carry out these activities

d. encouraging greater self-management of weed risks by competent parties by providing for the establishment of industry contribution schemes and auditable compliance agreements

e. appointing LLS as the single authority to control declared aquatic weeds within a specified region.

The NRC also recommends that the NSW Government advocate for a review of the requirements for obtaining a minor use permit to improve access to herbicides for incursions.

7 The NSW Government should actively support weeds research and development by:

a. rebuilding and maintaining NSW weeds research capacity

b. establishing a secure long-term funding strategy to deliver innovation and sustainable weed control outcomes together with the flexibility to respond to emerging priorities

c. prioritising areas for research and facilitating coordinated strategic research investment

d. supporting researchers to effectively communicate research findings to land managers

e. ensuring best available research and chemical choices are available to manage risk of herbicide resistance on roadsides.

2 Background

The Minister for Primary Industries requested the Natural Resources Commission (NRC) to undertake an independent evaluation of the effectiveness and efficiency of weed management arrangements in NSW, with the view of informing the further development of the proposed NSW Biosecurity Act, and other relevant strategies under the NSW Biosecurity Strategy 2013-2021. The NRC review has focused on existing good practice, opportunities and barriers that exist within current weed management arrangements, and ways to overcome the barriers.

2.1 About this review

The Minister's **terms of reference** (see Attachment 1), request the NRC to:

- assess (based on existing data) the distribution and abundance of weeds across NSW, their impacts, likely trajectories and risk creators and bearers
- evaluate current regulatory and institutional arrangements across both public and private tenures
- evaluate weed management programs funded by the Australian and NSW Governments
- identify and assess viable alternative weed management arrangements
- provide advice on potential transitional arrangements for the future implementation of the NSW Biosecurity Act and NSW Biosecurity Strategy 2013-2021.

For the purposes of the review:

- the assessment of the current and projected distribution and abundance of weeds and their impacts is to rely on existing data.
- weeds include both introduced and native species, but are limited to terrestrial and freshwater aquatic species. Marine species and environments are excluded. The review considered weeds defined under various legislation including noxious weeds (*Noxious Weeds Act 1993*), invasive native species and feral native species (*Native Vegetation Act 2003*), environmental weeds identified in the biodiversity priorities for widespread weeds, and Weeds of National Significance (WoNS) and National Environmental Alert List Weeds noted in the Australian Weeds Strategy.

The Commissioner for Natural Resources, Dr John Keniry AM, was asked to Chair a Steering Committee to ensure the terms of reference are met and stakeholder input is appropriately considered. The Steering Committee consists of Cr Reg Kidd, Chair of the Noxious Weeds Advisory Committee; Dr Bruce Christie, Executive Director of Biosecurity NSW, Department of Primary Industries; and Mr Mick O'Flynn, Acting Director, Park Conservation and Heritage, Office of Environment and Heritage.

Context for this review

The review of biosecurity legislation provides an opportunity to examine current weed management arrangements and identify opportunities to improve their effectiveness.
There have been several previous reviews into weed management in NSW, most recently the 2009 Weeds Summit, the 2011 Statutory Review of the *Noxious Weeds Act 1993*, and a Weed Management Task Force convened in 2011. While some recommendations have been implemented, there is still considerable community concern about weeds, as reflected at the Local Land Services (LLS) community consultation meetings, and in the many submissions received during preparation of this report.

Previous reviews identified issues with different aspects of weed management including: lack of equity in the treatment of public and private landholders, limited enforcement mechanisms, complex and often duplicative governance arrangements, lack of standardised reporting, the need for improved accountability, overlap and conflict between various pieces of weed legislation, separation of environmental and production-related weeds, and separation of native and non-native weeds.[7] [8] [9] [10] A detailed discussion of these is provided in the NRC weed management review Issues Paper.[11] The NRC has considered the findings of these reviews along with other evidence in forming the recommendations in this report.

Several other reviews are relevant to these draft recommendations and involve similar stakeholders. These include: the Independent Local Government Review; Review of NSW Crown Land Management; and review of the NSW Invasive Species Plan and the Australian Weeds Strategy.

Review approach

The NRC review uses best available evidence. The recommendations are aimed at improving outcomes, through more effective weed management. The NRC has consulted relevant Australian, state, regional and local government organisations, as well as industry, environmental and community groups. The process for completing the review is as follows:

Stage 1 - Issues Paper: The Issues Paper released in October 2013 was based on an initial literature review and consultation, including a workshop with weed management professionals and experts from local government, regional weed management groups, Catchment Management Authorities (CMAs), other government agencies, non-governmental organisations, community and research organisations.

Stage 2 - Consultation: The Issues Paper was available for public comment for six weeks ending 6 December 2013. The NRC received 206 submissions and a summary of the submissions is provided in Attachment 2.

The majority of submissions were provided by individuals and Local Government organisations (councils, county councils, weed authorities). Other stakeholders who provided comments included community organisations, environmental groups, industry, academia and the NSW Aboriginal Land Council. The NRC appreciates the time and effort stakeholders put into preparing thorough and thoughtful submissions. The submissions highlighted the impact that weeds have on a range of stakeholder groups, and provided useful insights that informed the draft recommendations.

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7 Gledhill, R. (2004), *Report on co-ordination and management of weeds in NSW*, prepared for the NSW Minister for Primary Industries, Sydney.

8 Noxious Weeds Advisory Committee (2009), *Final report: 2009 NSW Weed Summit*, Noxious Weeds Advisory Committee, Sydney.

9 NSW Department of Industry & Investment (2011), *Report on the Statutory Review of the Noxious Weeds Act 1993*, Department of Industry and Investment, tabled 7 September 2011.

10 Montoya, D. (2012), *Noxious Weeds Briefing Paper No 02/2012*. Parliamentary Library Research Services, ISBN 978-0-7313-1887-2.

11 Natural Resources Commission (2013), *Issues Paper: Review of weed management in NSW*, available at nrc.nsw.gov.au/content/documents/Weed management - issues paper.pdf, Natural Resources Commission, Sydney (accessed 2 December 2013).

Targeted consultation was also carried out from October to December 2013, including regional tours attended by Steering Committee members and local stakeholders, focus group meetings and key stakeholder interviews. A full record of consultation can be found in Attachment 3.

Stage 3 - Draft report: This report represents the findings from Steps 1 and 2. It is based on consultation, feedback on the Issues Paper and NRC analysis, and is available for public comment until 6 April 2014. Details of how to make a submission are provided in Section 2.2 below.

Stage 4 - Consultation: During the public comment period, the NRC will undertake additional consultation. Five public meetings are planned to be held in Wagga Wagga, Dubbo, Armidale, Grafton and Nowra.

Stage 5 - Final report: Following review of feedback from the final consultation phase, the NRC will issue a Final Report to the Minister by the end of May 2014.

2.2 How to provide a submission

The NRC invites submissions regarding this Draft Recommendations Report from members of the community and stakeholders. This feedback will inform the final recommendations. Submissions will be accepted until close of business on **6 April 2014**.

There is no standard format for submissions. Where possible, you should provide evidence, such as relevant data and documentation, to support your views. The NRC treats all submissions as public and makes them available on the NRC website unless a submission is clearly marked confidential or it contains material that is defamatory, offensive or in breach of any law. Details of the NRC Privacy Policy can be found via the Have Your Say website link below.

Electronic submissions can be provided through the Have Your Say website at:
http://engage.haveyoursay.nsw.gov.au/weed-management-review

Paper copy submissions can be faxed to (02) 8227 4399 or mailed to:

Weed Management Review
Natural Resources Commission
GPO Box 4206
Sydney NSW 2001

Submissions must be provided by the closing date to allow sufficient time for them to be considered before the final recommendations are made.

2.3 Guiding principles

Principles for an effective and efficient weed management system were developed in consultation with stakeholders (Table 2). The NRC review focuses on assessing the current arrangements against these principles and identifying barriers and opportunities for improved management systems, as well as ways of ensuring good practice.

Table 2: Principles for quality weed management systems

Principle	
Outcomes-focused	▪ arrangements should aim for best outcomes on the ground ▪ weed management is one part of overall sustainable landscape management for achievement of triple bottom line outcomes
Shared responsibility	▪ effective cooperation across tenures and jurisdictions ▪ coordinated collective action e.g. on widespread weeds ▪ clear understanding of roles and responsibilities
Evidence-based	▪ prioritised, risk-based programs based on best available science and research ▪ effective evaluation and reporting of outcomes
Consistent	▪ equity in approach across tenures (tenure-neutral) ▪ consistency in management of native and introduced invasive species ▪ consistency in planning and reporting processes
Responsive	▪ effective emergency response to new threats ▪ responsive/agile to prevent and control new incursions ▪ responsive and adaptable to emerging issues and new knowledge
Administratively effective and efficient	▪ aligned institutional arrangements, policies, legislation and funding ▪ action at scale appropriate to the problem ▪ research aligned with needs
Accountable	▪ appropriate and implementable compliance arrangements ▪ organisations at all scales held accountable for achieving results ▪ appropriate accountability of risk creators

2.4 Regulatory and institutional arrangements

The regulatory and institutional arrangements for managing weeds in NSW involve numerous pieces of legislation, departments, agencies and committees, and strategies, plans and lists (Figure 2).

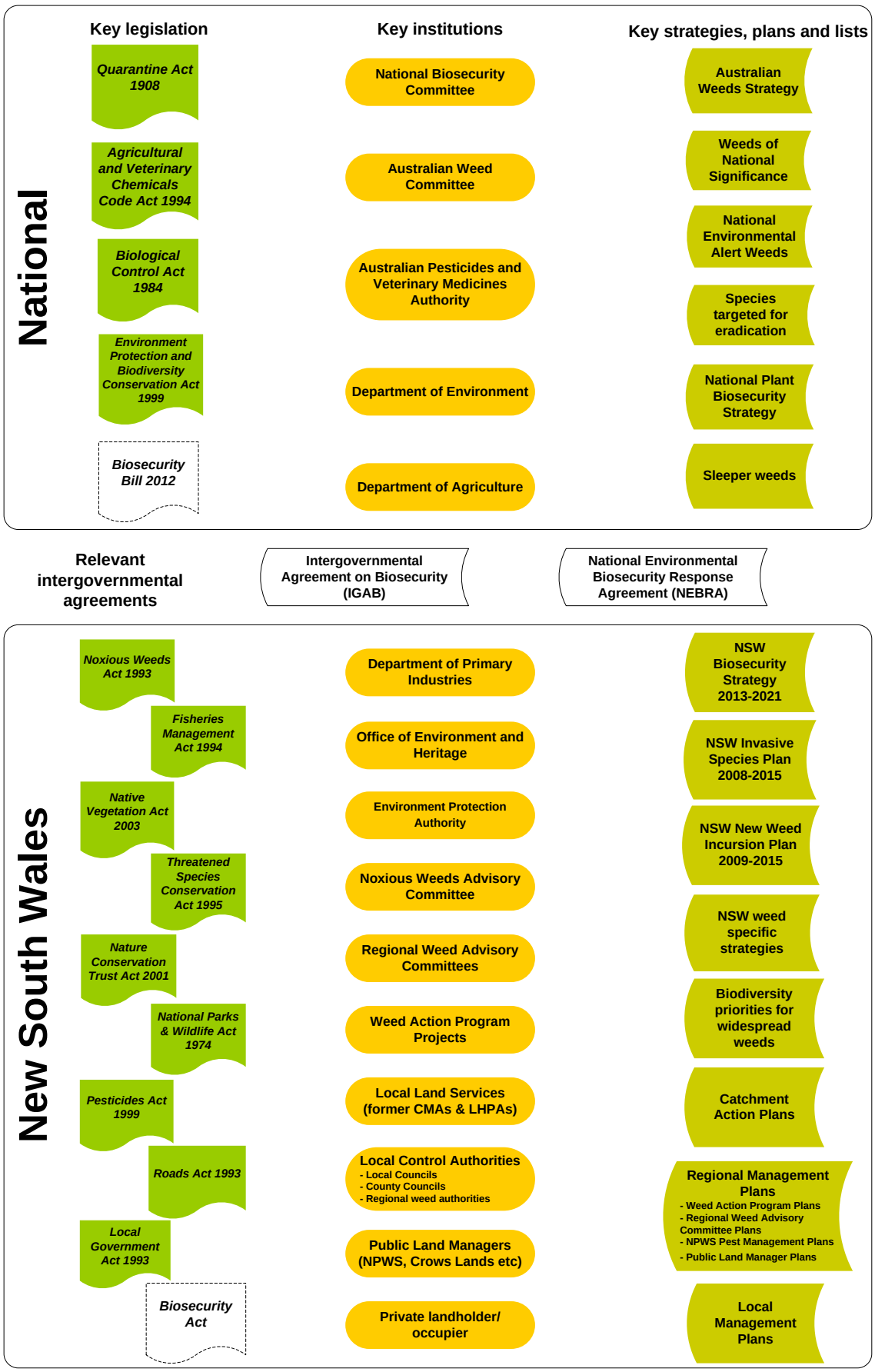

Figure 2: Regulatory and institutional arrangements for weed management in NSW

2.4.1 Regulatory arrangements

While all the legislation shown in Figure 2 influence weed management, the key pieces of legislation are:

- *Noxious Weeds Act 1993* (NSW) (and the *Noxious Weeds Regulation 2008*)
- *Native Vegetation Act 2003* (NSW) (and the *Native Vegetation Regulation 2013*)
- *Threatened Species Conservation Act 1995* (NSW)
- *Environment, Protection and Biodiversity Conservation Act 1999* (Cwlth)
- *Quarantine Act 1988* (Cwlth).

In general, this legislation seeks to prevent new weed incursions and minimise negative impacts of both native and non-native species on economic, environmental and social values. This is to be done through surveillance to prevent incursions, early eradication of incursions, management of widespread weeds, and capacity-building and education.

For the remainder of this report, an '**incursion**' is a weed invasion that is either newly identified or for which a determination has been made that it can and should be eradicated; and an '**infestation**' is a weed for which a determination has been made that regional eradication is either unfeasible or undesirable.

Noxious Weeds Act 1993

The Minister for Primary Industries administers the *Noxious Weeds Act 1993* with the assistance of the Department of Primary Industries (DPI). The Act aims to prevent the establishment of significant new weeds; prevent, eliminate or restrict the spread of particular significant weeds; and effectively manage impacts of widespread significant weeds. These goals align with the goals of the NSW Invasive Species Plan developed in 2008 to align actions for all invasive pests (plants, animals and diseases).

The Act provides for the making of Weed Control Orders, which declare weeds as noxious and specify the area to which the order applies, objectives of control and the specific control measures required.

The current Weed Control Order (order 28) includes 190 weeds. Weeds are listed by Local Control Authority (LCA) boundary or state-wide. A new order comprising 239 taxa is due for gazettal in the near future.[12] Some native taxa are included in these orders; native plants can be declared as noxious with the consent of the Minister for the Environment (in accordance with the *National Parks and Wildlife Act 1974*).[13]

Five classes of noxious weeds are defined as shown in Table 3 below. The DPI website indicates that noxious weeds are "*plants that have potential to cause harm to the community and individuals, can be controlled by reasonable means and have the potential to spread within an area and to other areas. A weed is declared noxious because its control will provide a benefit to the community over and above the cost of implementing control programs*."[14] This definition is consistent with DPI policy that the benefits of action should outweigh the costs, but is not specified in the legislation or regulations.

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12 DPI, personal communication, 9 December 2013.

13 The Minister for the Environment is also responsible for administering the *Native Vegetation Act 2003* and *Threatened Species Conservation Act 1995* (NSW), with the assistance of the Office of Environment and Heritage (OEH).

14 NSW Department of Primary Industry Weeds Definitions and FAQ, available at: dpi.nsw.gov.au/agriculture/pests-weeds/weeds/definition (accessed December 2013).

Table 3: Control classes of noxious weeds – definitions and control requirements

Control class	Weed type (definition)	Typical control requirements[15]
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the **state** or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a **region** to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a **region** to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed **in an area** to which the order applies and are likely to spread in the area or to another area.	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction.*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the **state** or an area of the state, to spread in the state or outside the state.	There are no requirements to control existing plants of Class 5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.

*Some Class 4 plant listings require continuous inhibition of flowering and some are prohibited from sale, knowing propagation or distribution.

The *Noxious Weeds Act 1993* has undergone a number of amendments to improve its implementation.[16] The most recent suite of amendments was made in 2012 following a five-year statutory review of the Act and a separate review of Primary Industries legislation.[17]

Native Vegetation Regulation 2013

Native plants that are considered weedy can be declared under the *Native Vegetation Regulation 2013* as either feral native species or invasive native species. Feral native species generate impacts outside of their natural range and for ground cover, within their natural range. Invasive native species are those that generate impacts within their natural range through dense regeneration or are invading plant communities in which they do not generally occur.

15 Specified in Weed Control Order 28.
16 Montoya, D. (2012), *Noxious weeds briefing paper no 02/2012*. Parliamentary Library Research Services.
17 NSW Department of Industry & Investment (2011), *Report on the Statutory Review of the Noxious Weeds Act 1993*, Department of Industry and Investment, tabled 7 September 2011.

The clearing of feral native species or invasive native species is deemed a routine agricultural management activity, if carried out in accordance with a relevant order. Clearing of these species is also permitted on land identified as protected riparian land by a natural resource management plan.[18]

Fifty-one weed species are currently listed under this regulation:

- **Invasive native species –** 49 native species are recognised as having invaded vegetation communities where the species have not been known to occur previously (but are within their natural range) OR the species regenerates densely following natural or artificial disturbance.
- **Feral native species –** two native species are currently recognised as having invaded vegetation communities outside of their natural range, including coastal tea-tree (*Leptospermum laevigatum*) and yellow mimosa (*Vachellia farnesiana*).

Threatened species regulations

The NSW *Threatened Species Conservation Act 1995* and the *Environment, Protection and Biodiversity Conservation Act 1999* (Cwlth) provide for the listing of invasive species, including weeds, as key threatening processes. Key threatening processes listed under the NSW legislation are intended to be consistent with those listed under the Commonwealth Act.[19] The listing reflects the threats posed by weeds to biodiversity, specifically threatened native species or ecological communities. The NSW Office of Environment and Heritage (OEH) and the Australian Government Department of Environment develop threat abatement plans to address these key threatening processes. The first weed threat abatement plan in Australia was developed for bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*).[20]

Biodiversity priorities for widespread weeds

The *Biodiversity Priorities for Widespread Weeds* was developed by DPI and OEH, in conjunction with CMAs and other regional partners. This list is based on an assessment of the weeds that cause the greatest impact to high-priority assets from a conservation perspective. A separate list of priorities was developed for each CMA region. The National Parks and Wildlife Services (NPWS) use these lists to prioritise weed management on their lands.

Australian Government weed lists

The Australian Government has several non-statutory lists including WoNS, the National Environmental Alert Weeds list and the sleeper weeds list. These weeds are listed as priority weeds for control in non-enforceable agreements between the Australian Government and states and territories. WoNS are chosen based on a process agreed to by the Ministers for Forestry and Conservation, Agriculture and Environment. Weeds on this list are those regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts on several states and territories. The selection of these weeds is based on

18 *Native Vegetation Regulation 2013* (NSW) cl 58.

19 Cattanach, G., Harris, A. and Horris, J. (2013), *Mapping Australia's Weed Management System*. Publication number 13/019. Rural Industries Research and Development Corporation, Canberra.

20 Sinden, J., Downey, P.O., Hester, S.M. and Cacho, O. (2008), "Economic evaluation of the management of bitou bush (*Chrysanthemoides monilifera* subsp *rotundata* DC. (T.Norl.) to conserve native plant communities in New South Wales", *Plant Protection Quarterly*, 23(1): pp. 34-37.

specific criteria, including the requirement that management of the weed must benefit from national coordination.

Weeds on the National Environmental Alert Weeds list are non-native plant species in the early stages of establishment and with the potential to become a significant threat to biodiversity if they are not managed. Sleeper Weeds are non-native plants that have naturalised, but have not yet reached their potential to form large and widespread populations (despite being naturalised for some years).

2.4.2 Institutional arrangements

A complex set of institutional arrangements has developed to manage weeds at national, state, regional and local scales.

National arrangements

The Australian Government is responsible for preventing new weedy species from entering the country. This is done through implementation of the Australian Weed Risk Assessment System to assess the risks of newly proposed species, border control measures and quarantine operations.

Australian and state governments work together through several national committees related to biosecurity and weed management (Figure 2). The committees guide and coordinate the various institutions responsible for delivering plant biosecurity outcomes. There are also intergovernmental agreements and a national strategy for management of weeds.

National Biosecurity Committee

The National Biosecurity Committee supports the Primary Industries Standing Committee. It was established in July 2008 to provide strategic leadership in managing national approaches to emerging and ongoing biosecurity policy issues across jurisdictions and sectors. The National Biosecurity Committee takes an overarching, cross-sectoral approach to national biosecurity policy, and works collaboratively to achieve national policy objectives for biosecurity in Australia. The committee provides leadership to a range of supporting committees.

Australian Weeds Committee

The Australian Weeds Committee is a sub-committee of the National Biosecurity Committee and is an inter-governmental mechanism for identifying and resolving weed issues at a national level. It aims to ensure an integrated and effective national approach to the prevention and management of weed problems by reporting to and advising the National Biosecurity Committee.

Australian Weeds Strategy

The Australian Weeds Strategy was developed by the Australian Weeds Committee. It provides a national strategic approach and framework for establishing consistent guidelines. It identifies national priorities for weed management with the aim of minimising the impact of weeds on Australia's environmental, economic and social assets.

The Intergovernmental Agreement on Biosecurity

The Intergovernmental Agreement on Biosecurity (IGAB) is an agreement between the Australian, state and territory governments (with the exception of Tasmania) that came into effect in January 2012. The agreement aims to strengthen the working partnership between governments, improve the national biosecurity system by specifying roles and responsibilities, and outline the priority areas for collaboration.

National Environmental Biosecurity Response Agreement – (Council of Australian Governments Agreement)

The National Environmental Biosecurity Response Agreement (NEBRA) is the first deliverable of the IGAB, signed in November 2012. It sets out emergency response arrangements, including cost-sharing, for biosecurity incidents that primarily impact the environment and/or social amenity. NEBRA contains provisions for how the cost-sharing between governments will work in environmental biosecurity eradication responses, and is only geared for responses where eradication is the goal. While the NEBRA is a cost-sharing arrangement between the Australian and state governments, private beneficiaries (i.e. industries) also can be invited to participate if it is deemed necessary. NEBRA can only be used when the pest is declared eradicable by the National Biosecurity Management Group and there are no provisions for transition to management or other arrangements.

NSW institutional arrangements

A range of bodies at different scales have weed management responsibilities within NSW.

LCAs have a responsibility under the *Noxious Weeds Act 1993* for surveillance and enforcement on private lands as well as control of noxious weeds on their own lands. LCAs are by default the local councils, but a local council may designate another authority to carry out their duties. LCAs currently include single councils, county councils and weed authorities. Historically, DPI has provided funds to assist LCAs to carry out their duties. This is currently done through the Weed Action Program (WAP).

There are several participants in weed management at the regional level:

- **Weed Action Program (WAP) groups -** DPI administers funds to 'lead agencies' established for regional groups of LCAs. There are 13 WAP regions. Each region is responsible for developing a variety of plans for management of weeds.
- **Regional Weed Advisory Committees** (RWACs) - regional organisations developed to help strategically organise weed management at a regional level. Their objectives and activities vary, but they generally focus on providing a forum for weed-related information-sharing and supporting capacity-building and education.
- **Local Land Services -** incorporates functions of:
    - **CMAs –** strategic planning and funding for overall natural resource management, taking a landscape-based approach.
    - **Livestock Health and Pest Authorities (LHPAs) –** pest animal control, livestock health and maintenance of travelling stock reserves.
    - **Agricultural extension services –** providing advice regarding production issues and communicating agricultural research findings.

DPI is responsible for administration of the *Noxious Weeds Act 1993*, as such it develops policies and legislation and provides state-level oversight of, and support for, weed management programs. Biosecurity NSW, part of DPI, develops state-wide policies and programs for management of all biosecurity risks, including the NSW Biosecurity Strategy 2013-2021. In addition to funding LCA activities, DPI funds state-wide projects.

The NSW Biosecurity Strategy 2013-2021 outlines how government, industry and the community need to work together to identify, minimise, respond to and manage biosecurity risks. It aims to highlight the importance of biosecurity for NSW. The objectives of the strategy are to manage pest, disease and weed risks by:

- preventing their entry in to NSW
- quickly finding, containing and eradicating any new entries
- effectively minimising the impacts of those pests, diseases and weeds that cannot be eradicated.

Under the *Noxious Weeds Act 1993*, the Minister may create committees to advise on weed management. The Minister has delegated one such committee - the Noxious Weeds Advisory Committee - to provide advice on a range of weed management issues, including the review of proposed weed declarations.

OEH administers the *Threatened Species Conservation Act 1995* and the *Native Vegetation Act 2003*, and is responsible as a public land manager for management of weeds in national parks.

Public land managers including OEH, Crown Lands, Forestry Corporation NSW, Sydney Catchment Authority, Country Rail Network, State Water, and Roads and Maritime Services are responsible for ensuring weeds do not spread from their properties. Public land makes up a large portion of the NSW land area. Private landholders are responsible for controlling all declared weeds in accordance with the Weed Control Orders.

3 Distribution and impacts of weeds in NSW

Key findings:

- Distribution mapping of weeds in NSW is highly inconsistent, making it difficult to get a complete picture of how weed density and extent are progressing across the state. While there are success stories with measurable outcomes, there are insufficient data to track the outcomes of most weed management efforts. This is a fundamental problem with current systems, as managers cannot accurately assess progress or effectively plan where and how to best target weeds.
- Evidence indicates that the impacts and distribution of weeds are increasing and weeds cause considerable economic, environmental and social impacts across all of NSW.
- A consistent set of data protocols and a centralised mapping system are urgently needed to enable outcomes to be assessed and facilitate adaptive management to ensure resources are spent where they are most effective.

As part of its terms of reference, the NRC is required to assess the distribution and abundance of weeds across NSW, including their economic, social and environmental impacts. This chapter examines impacts of weeds, historical trends (where possible), likely pathways and trajectories for weed distribution, and associated risks.

As will be discussed throughout the chapter, **there are significant limitations to the evidence that is available.** However, best available information sourced for this analysis includes:

- spatial datasets from DPI, OEH, Royal Botanic Gardens & Domain Trust (PlantNET) and the Atlas of Living Australia
- relevant literature
- relevant databases, including PlantNET
- climatic modelling
- advice from weeds specialists.

3.1 Economic, environmental and social impacts

3.1.1 Economic impacts of weeds

Weeds can significantly impact on primary production including in the cropping, grazing, horticulture and forestry sectors. Weeds in agricultural systems directly impact on crop and pasture yields, increase production costs, reduce product quality and result in product contamination.[21] The latter can result in price penalties[22] or market access barriers.

[21] Groves, R.H., Boden, R. and Lonsdale, W.M. (2005), *Jumping the Garden Fence: Invasive garden plants in Australia and their environmental and agricultural impacts*. CSIRO report prepared for the World Wildlife Fund - Australia, Sydney.

[22] Jones, R.E., Vere, D.T., Alemseged, Y. and Medd, R.W. (2005), "Estimating the economic cost of weeds in Australian annual winter crops", *Agricultural Economics*, 32: pp. 243 –265.

The decreased value of production resulting from weed-related problems is recognised at the state and national scale as one of the most significant problems for agricultural businesses.[23] As demonstrated by the examples below, weed invasion significantly affects returns and property values.

- Complete crop failure can occur if weeds are not controlled in rice crops, hence the majority of Australian rice crops are treated with herbicide.[24]
- Pasture-carrying capacity can be reduced from 7-15 dry sheep equivalent per hectare to an average of 0.5 where there is a heavy infestation of serrated tussock (*Nassella trichotoma*).[25]
- Contamination of sheep carcasses by weed seed, such as Chilean needle grass (*Nassella neesiana*), is estimated to reduce carcass values by as much as $1 per kilogram.[26]
- Lantana (*Lantana camara*) was estimated to cost the NSW grazing industry $33.4 million in lost production in 2005-2006.[27]

Weed management is one of the most significant production costs and takes resources away from other activities. Based on farm surveys undertaken by the Australian Bureau of Statistics, NSW agricultural businesses made the greatest expenditure of any jurisdiction on weed management in 2006-07, at $475 million. Management of weed-related problems was the most reported activity undertaken by NSW agricultural businesses compared with pest-related, and other land and soil activities. Herbicide application was the most common weed management activity.

As shown in Table 4, weed management involves the highest cost and most intensive effort by area compared with other pest, land and soil problems. These costs could potentially escalate in the future given that there is a pattern of increasing herbicide resistance in some crop weeds, particularly annual grasses.[28] The resistance of weeds to certain herbicides has become a significant challenge for the Australian grains industry.[29] It threatens minimum and no tillage practices that have helped to address other land management problems such as soil erosion and declining soil structure.

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23 Australian Bureau of Statistics (2008), *Natural resource management on Australian farms: 4620.0 2006-7*, Australian Bureau of Statistics, Canberra.

24 Cattanach, G., Harris, A. and Horris, J. (2013), *Mapping Australia's Weed Management System*, Publication number 13/019. Rural Industries Research and Development Corporation, Canberra.

25 Campbell, M.H. and Vere, D.T. (1995), *Nassella trichotoma* (Nees). Arech., *The Biology of Australia Weeds*, *Volume 1*, . RH Groves, RCH Shepard and RG Richardson (eds) Melbourne pp. 189-202.

26 o*p.cit.* Cattanach *et al* (2013).

27 Department of Natural and Water Resources (2007), *Economic impacts of lantana on the Australian grazing industry", Report prepared for the Department of Natural and Water Resources*, available at: weeds.org.au/WoNS/lantana/docs/60_Lantana_Grazing_EIA_Final_Report_(b).pdf (accessed 2 December 2013)

28 Groves, R.H., Boden, R. and Lonsdale, W.M. (2005), *Jumping the Garden Fence: Invasive garden plants in Australia and their environmental and agricultural impacts*. CSIRO report prepared for the World Wildlife Fund - Australia, Sydney.

29 o*p.cit.* Cattanach *et al* (2013).

Table 4: Expenditure and effort reported by NSW agricultural businesses on problems related to weed, pest, and land and soil for 2006-07[30]

	Weed related activities	Pest related activities	Land and soil related activities
Proportion of agricultural businesses reporting activities	90.9%	82.0%	62.4%
Total expenditure	$475 million	$242 million	$216 million
Average expenditure per agricultural business	$10,986	$6,207	$7,260
Average expenditure per 1,000 hectares	$10,528	$4,565	$5,672
Total effort (in person days)	1,396,019	1,026,249	715,224
Average effort per agricultural business (person days)	32	26	24
Average effort per 1,000 hectares (person days)	31	19	19

Weed impacts vary greatly by agricultural industry. Consequently, yield losses due to weeds also vary extensively. For example, losses incurred by fruit and vegetable producers are estimated to be 1 per cent, grazing industries are estimated to incur losses of around 5 per cent, while the cotton industry is estimated to incur losses as high as 15 per cent.[31] For 2001-2002, yield losses by broad industry groups nationwide were estimated as $346 million for cropping, $1.87 billion for livestock and $2 million for horticulture, totalling $2.218 billion for Australian agriculture.[32]

Invasive garden plants are considered to pose one of the greatest threats to agriculture, including the grazing sector. Two hundred and eighty-one species of garden plant potentially pose a significant threat to Australian grazing industries.[33] A third of these species (33 per cent) are considered toxic to livestock and the majority are perennials (83 per cent). Serrated tussock is one of the most problematic weeds for grazing systems and is estimated to cost the industry of south-east Australia, around $50 million per year.[34] Other invasive plants that have significantly impacted the grazing sector include Paterson's curse (*Echium plantagineum*), which is toxic to livestock, and Lippia (*Phyla canescens*) which is unpalatable to livestock.[35] African lovegrass (*Eragrostis curvula*) is also threatening the viability of grazing industries.

30 This table has been adapted from the Australian Bureau of Statistics (2008), *Natural resource management on Australian farms: 4620.0 2006-7*, Australian Bureau of Statistics, Canberra. It includes the Australian Capital Territory.

31 Sinden, J., Jones, R., Hester, S., Odom, D., Kalisch, C., James, R. and Cacho, O. (2004), *The economic impacts of weeds in Australia*, CRC for Weed Management. Technical series no. 9.

32 *ibid*.

33 Barker, J., Randall, R. and Grice, T. (2006), *Weeds of the future? Threats to Australia's grazing industries by garden plants,* Meat and Livestock Australia Limited, North Sydney.

34 Briese, D.T., Pettit, W. and Anderson, F. (2001), *Biological control of serrated tussock and Chilean needlegrass*, Publication number 01/27. Rural Industries Research and Development Corporation, Canberra.

35 Groves, R.H., Boden, R. and Lonsdale, W.M. (2005), *Jumping the Garden Fence: Invasive garden plants in Australia and their environmental and agricultural impacts*, CSIRO report prepared for the World Wildlife Fund - Australia, Sydney.

Broad-leaved and grassy weeds both impact on cropping systems in Australia. They directly compete with crop species, contaminate harvest and increase resource requirements (labour, equipment, energy consumption and herbicide applications). The incidence of grassy weeds has increased as cropping frequency has intensified.[36] This increase was so significant that weeds were at one stage the primary factor affecting crop performance, until herbicides and other techniques for weed management were developed. Annual ryegrass (*Lolium rigidum*) is considered one of the most problematic weed species in cropping systems[37], particularly in the southern grain region of Australia that includes a large area of central and southern NSW.[38] This region experienced some of the greatest losses from grain contamination. Wild oats (*Avena sativa*) has had the greatest impact on yields in the northern growing region, which includes cropping areas of northern and central NSW. However, neither of these species is declared a noxious weed in NSW.

Aquatic weeds also have significant impacts on primary industries. They have been found to reduce the flow capacity of irrigation canals, thereby impacting on water available for farm use and increasing costs due to pump damage and weed control.[39] Weeds also de-oxygenate the water, which can lead to fish kills and impact on fisheries. In some cases, non-native aquatic plants can improve water quality through water filtration and purification[40], thereby reducing agricultural (and domestic and industrial) pollution.

3.1.2 Environmental impacts of weeds

Weed invasion can have significant impacts on biodiversity. Weed invasion of native plant communities is a key threatening process under the NSW *Threatened Species Conservation Act 1995*[41] and the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).[42] A quantitative analysis of the threat that weeds pose to biodiversity concluded that weeds threaten around 45 per cent of NSW threatened biodiversity. The majority of these weeds are widespread, with the greatest density of observations recorded in coastal areas. This demonstrates the relative importance of managing weed species to minimise environmental impacts, particularly at a landscape scale.

Modelling of weeds that pose the greatest threat to biodiversity identified three species that are an extreme priority for biodiversity protection.[43] They include Madeira vine (*Anredera cordifolia)*, lantana and bitou bush. A further 20 species were identified as very high priority weeds (Table 5). More than half of the species that fall in these categories are WoNS. All but one of these 20 are listed as noxious weeds under the NSW *Noxious Weeds Act 1993*. However, most of them are listed

36 Reeves, T.G. (2008), *Global changes: impacts on weeds in cropping systems,* Proceedings of the Sixteenth Australian Weeds Conference, Cairns, Australia, available at: caws.org.au/awc/2008/awc200810011.pdf (accessed December 2013).

37 Nikman, S. R., Moerkerk, M. and Cousens, R. (2002), *Weed seed contamination in cereal and pulse crops*, Proceedings of the thirteenth Australian Weeds Conference, Perth, Australia, available at: caws.org.au/awc/2002/awc200210591.pdf (accessed December 2013).

38 Jones, R.E., Vere, D.T., Alemseged, Y. and Medd, R.W. (2005), "Estimating the economic cost of weeds in Australian annual winter crops", *Agricultural Economics*, 32: pp. 243 –265.

39 International Commission on Irrigation and Drainage (2002), *Aquatic Weeds and their Management*, International Commission on Irrigation and Drainage, New Delhi, available at: icid.org/weed_report.pdf (accessed December 2013).

40 Pejchar, L. and Mooney, H.A., (2009), "Invasive species, ecosystem services and human well-being", *Trends in Ecology and Evolution*, 24 (9): pp. 497-504.

41 Details of the 37 key threatening processes listed under the NSW *Threatened Species Conservation Act 1995* are available at: environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm (accessed December 2013).

42 Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants is listed as a key threatening process under the *Environment, Protection and Biodiversity Conservation Act 1999*.

43 Downey, P.O., Scanlon, T.J. and Hosking, J.R. (2010), "Prioritizing weed species based on their threat and ability to impact on biodiversity: a case study from New South Wales", *Plant Protection Quarterly*, 25(3): pp. 111- 126.

as 'Class 4' weeds, some in only a small number of LCAs, even though they are known to be more broadly present. As such they are causing impacts in many areas where they are not currently declared as noxious. For instance, OEH indicated that Madeira vine, an extreme priority, is only declared noxious in the Sydney region although it is creating significant impacts in north-eastern NSW.[44] Japanese honeysuckle *(Lonicera japonica*) is not currently recognised as a noxious weed and is commonly grown in gardens. Two species are aquatic weeds (alligator weed (*Alternanthera philoxeroides*) and salvinia (*Salvinia molesta*)) and they pose a serious threat to the river health and ecology of the Murray-Darling Basin.[45]

Table 5: Extreme and very high priority weeds that pose a threat to biodiversity in NSW

Priority	Common name	Scientific name	Weed of national significance	NSW noxious weed control class (under order 28)
Extreme	Madeira vine	*Anredera cordifolia*	✓	Class 4 (not state-wide)
Extreme	lantana	*Lantana camara*	✓	Class 3 and 4
Extreme	bitou bush	*Chrysanthemoides monilifera*	✓	Class 2, 3 and 4
Very high	ground asparagus	*Asparagus aethiopicus*	✓	Class 4 (not state-wide)
Very high	blackberry	*Rubus fruticosus*	✓	Class 4 (not state-wide)
Very high	scotch broom	*Cytisus scoparius*	✓	Class 4 (not state-wide)
Very high	Japanese honeysuckle	*Lonicera japonica*		-
Very high	large leafed privot	*Ligustrum lucidum*		Class 4 (not state-wide)
Very high	narrow-leaf privot (small leafed privot)	*Ligustrum sinense*		Class 4 (not state-wide)
Very high	alligator weed	*Alternanthera philoxeroides*	✓	Class 2 and 3
Very high	cat's claw creeper	*Macfadyena unguis-cati*	✓	Class 4 (not state-wide)
Very high	salvinia	*Salvinia molesta*	✓	Class 2 and 3
Very high	gorse	*Ulex europaeus*	✓	Class 2 and 3
Very high	boneseed	*Chrysanthemoides monilifera*	✓	Class 2 and 3
Very high	serrated tussock	*Nassella trichotoma*	✓	Class 3 and 4
Very high	cape ivy	*Delairea odorata*		Class 4 (not state-wide)
Very high	blue morning glory	*Ipomoea indica*		Class 4 (not state-wide)
Very high	balloon vine	*Cardiospermum grandiflorum*		Class 4 (not state-wide)
Very high	lippia	*Phyla canescens*		Class 4 (not state-wide)
Very high	bridal creeper	*Asparagus asparagoides*	✓	Class 4 (not state-wide)
Very high	ochna	*Ochna serrulata*		Class 4 (not state-wide)
Very high	turkey rhubarb/ rambling dock	*Acetosa sagittata*		Class 4 (not state-wide)

[44] OEH, personal communication, 9 February 2014.
[45] Low, T. (2009), *Climate change and weeds and pests in the Murray-Darling Basin*, Report prepared for the Murray-Darling Basin Authority, Canberra.

3.1.3 Social impacts of weeds

Weeds can have negative and positive social impacts. They may be valued for their visual amenity, but are also disliked due to the health problems that arise from weed allergens (such as respiratory illnesses and skin irritation), land access issues and their impacts on recreational users. For example, an outbreak of salvinia that occurred in the Hawkesbury-Nepean system during the summer of 2003-2004, significantly disrupted recreational users and affected the income of local industries including tour boat operators, ski and caravan parks and commercial fishers.[46] The significant impacts of the outbreak led to a mayoral forum to determine how to control the salvinia infestation and mitigate its impacts.[47] An outcome of this forum was the development of the Hawkesbury-Nepean River Health Strategy (by Hawkesbury-Nepean CMA).

The social impacts of weeds are generally difficult to quantify as the values placed on ecosystem services are highly subjective.[48] Given the difficulty of quantifying these impacts, limited literature is available on the social costs of weed invasion. A recent literature review found that a number of weed interactions were under-represented in scientific research, notably the social impacts of weeds.[49] Without this research, it is difficult to ascertain how the presence of weeds influences people's behaviours, including how they use a landscape. In this case, the literature review focused on coastal landscapes, but it recognised that further research is required to build an understanding of the impacts of weeds for a broader range of landscapes.[50]

Perhaps the more widely researched fields are the impacts of weeds on human health, recreation and tourism. This is because economic indicators can be used to quantify these weed impacts. For example, the per capita expenditure arising from allergic reactions to Parthenium weed was estimated to be $6.90 per person ($19.90 per household) in affected areas in 2001, and annual benefits from controlling the weed were estimated at $6.8 million.[51]

Much of the social research into weed impacts has historically focused on farmers and rural landholders, and to a lesser extent on urban stakeholders, culturally diverse groups and Indigenous people.[52] This is possibly because the interaction between weeds and cultural and spiritual values is so complex.[53] A recent investigation into Aboriginal people's perspectives of weeds identified a number of impacts that are of concern to Aboriginal people, namely how weeds restrict access to land, alter culturally significant landscapes, destroy the habitat of valued food species and affect the integrity of cultural relationships to the land.[54]

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46 Hawkesbury-Nepean Catchment Management Authority (2007), *Hawkesbury-Nepean River Health Strategy*, Hawkesbury-Nepean Catchment Management Authority, Goulburn, Australia.

47 Penrith City Council (2004), *Mayoral Aquatic Weeds Forum, Control the Outbreak of Salvinia in the Hawkesbury-Nepean River System*, organised by Penrith City Council, Penrith, NSW, August 2004, available at: penrithcity.nsw.gov.au/uploadedFiles/Website/Your_Council/Publications/ARBluettAward/2004-2005/Environment.pdf (accessed December 2013).

48 Pejchar, L. and Mooney, H.A. (2009), "Invasive species, ecosystem services and human well-being", *Trends in Ecology and Evolution*, 24 (9): pp. 497-504.

49 Cousens, R., Kennedy, D., Maguire, G. and Williams, K. (2013), *Just how bad are coastal weeds? Assessing the geo-eco-psycho-socio-economic impacts,* Publication number 013/0132. Rural Industries Research and Development Corporation, Canberra.

50 *ibid.*

51 AECgroup (2002), *Economic impact of State and Local Government expenditure on weed and pest animal management in Queensland*, a report for the Local Government Association of Queensland.

52 Alsin, H.J., Krouger, H., Thompson, L-J. and Duncan, A.J. (2013), *Systematic review of Australian weed related social surveys*, publication number 13/018. Rural Industries and Research Development Corporation, Canberra.

53 *op.cit.* Pejchar and Mooney, (2009).

54 Rural Industries and Research Development Corporation (2012), *Weed management on indigenous lands: Indigenous values, perceptions and capacity*. *National weed research: a summary of research outcomes from the National Weeds and Productivity Research Program 2011-2012*, Rural Industries and Research Development Corporation.

3.2 Plant naturalisation

More than 1,749 plant taxa have been introduced[55] and naturalised[56] in NSW since European settlement.[57] This includes:

- plants that are considered exotic to Australia
- plants that are exotic to NSW, but native to Australia
- plants that are native to NSW, but which have expanded their range into new areas.

A number of these plants are now recognised for the threats they pose to biodiversity, the community and the economy.

The rate of plant naturalisation in NSW appears to have increased in recent years. Following European settlement in 1788, the overall rate of plant naturalisation was estimated to be 7.7 taxa per year, which is below the rate of approximately 10 taxa per year for other areas of Australia.[58] [59] However, the recorded rate of plant naturalisation in NSW has increased since 2000 to 18.7 taxa per year (based on data records for the period 2000-2012).[60] It has been postulated that this may be a result of increased research into naturalisation[61] and improved detection methodology.

Twenty-four of the 243 taxa recorded as being naturalised between 2000 and 2012 are currently declared as noxious weeds[62], after being assessed within the NSW Weed Risk Management System.[63] Occurrence records for these species are shown in Figure 3.

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55 Defined as "…the arrival of a new species accidentally or deliberately to a region" as described in Groves, R.H., Boden. R., and Lonsdale, W.M. (2005), *Jumping the Garden Fence: Invasive garden plants in Australia and their environmental and agricultural impacts,* CSIRO report prepared for World Wildlife Fund-Australia.

56 Defined as "..whereby a plant species can propagate without cultivation." As described in Groves, R.H., Boden. R., and Lonsdale, W.M. (2005), *Jumping the Garden Fence: Invasive garden plants in Australia and their environmental and agricultural impacts,* CSIRO report prepared for World Wildlife Fund -Australia.

57 J. Hosking (personal communications, January 2013) cited in Johnson, S.B. (2013), *Some weeds have no boundaries. What are the next steps we need to take with species that jump the fence?,* Proceedings of the 17th Biennial NSW Weeds Conference, Corowa. (NSW DPI, Orange).

58 Brodie, C.J. and Reynolds, T.M. (2012), *Review of recent plant naturalisations in South Australia and initial screening for weed risk*, DENR Technical Report 2012/02, South Australian Department of Environment and Natural Resources, Adelaide, pp. 29.

59 Groves, R.H. and Hosking, J.R. (1997), *Recent incursions of weeds to Australia 1971-1995*, Technical Series No. 3. Cooperative Research Centre for Weed Management Systems, Adelaide.

60 Johnson, S.B. (2013), *Some weeds have no boundaries. What are the next steps we need to take with species that jump the fence?,* Proceedings of the 17th Biennial NSW weeds conference, Corowa. (NSW DPI, Orange).

61 Hosking, J.R., Conn, J.B. and Lepschi, B.J., (2003) "Plant species first recognised as naturalised for New South Wales over the period 2000-2001". *Cunninghamia* 8(2): pp. 175-187; Hosking, J.R, Conn, J.B., Lepschi, B.J. and Barker, C.H. (2007) "Plant species first recognised as naturalised for New South Wales in 2002 and 2003, with additional comments on species recognised as naturalised in 2000–2001." *Cunninghamia* 10(1): pp. 139-166; Hosking, J.R, Conn, J.B., Lepschi, B.J. and Barker, C.H. (2011) "Plant species first recognised as naturalised or naturalising for New South Wales in 2004 and 2005." *Cunninghamia* 12 (1): 85 - 114.

62 DPI, personal communications, 30 October 2013.

63 The NSW Weed Risk Management system includes a series of questions that are used to derive a score for weed risk (which covers invasiveness, impacts and potential distribution) and the feasibility of coordinated control (which includes control costs, persistence, and current distribution). Further details on the Weed Risk Management system can be found at dpi.nsw.gov.au/__data/assets/pdf_file/0004/279958/INT09-54079-revised-Weed-Risk-Management-Background-information-book.pdf. (accessed 2 December 2013).

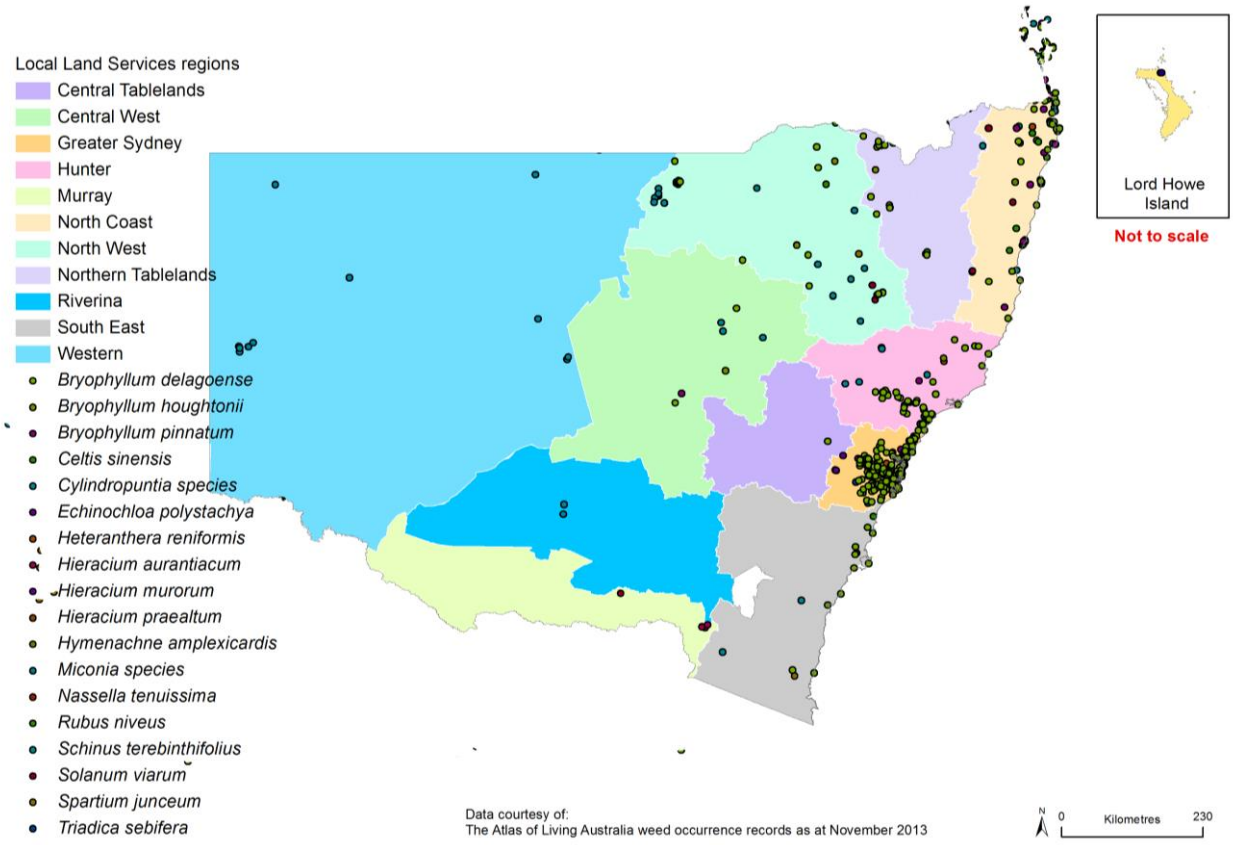

Figure 3: Occurrence of declared noxious weeds recorded as naturalised in NSW between 2000 and 2012

Table 6 lists the number of introduced species that have been recorded for each NSW botanical district over the past four years. This list is not limited to declared noxious weeds. The number of introduced species generally decreases from east to west, with the North Far Western Plains botanical district having the lowest number of introduced species. The North Coast district had the highest number of introduced species recorded over the past four years, at 51 new species.[64] This district, which primarily falls within the North Coast LLS region, includes one of Australia's 15 biodiversity hotspots and is considered the most biologically diverse area in NSW.[65] It supports the greatest number of native plants and animal species of any area in NSW, including the greatest number of threatened species.[66]

It is difficult to ascertain whether the number of weeds recorded in the North Coast district is a reflection of monitoring and detection efforts by weeds officers[67] and the community, habitat suitability for weeds, the diverse micro-climates of the region or incursions from Queensland. It is likely due to a combination of these factors. Introduced species in this district include the first recorded observation of tropical soda apple (*Solanum viarum*) in NSW. This species was then recorded in the North Western Slopes district in December 2010.

64 Royal Botanic Gardens & Domain Trust (2013). *PlantNET - The Plant Information Network System of the Royal Botanic Gardens & Domain Trust, Sydney, Australia*, available at: plantnet.rbgsyd.nsw.gov.au

65 The Border Ranges North and South, which straddles northern NSW and southern Queensland, includes a range of habitats that are threatened by weeds, fire and recreational activities, available at: environment.gov.au/node/13909 - hotspot3 (accessed 2 December 2013).

66 Coutts–Smith, A.J. and Downey, P.O. (2006), *Impact of weeds on threatened biodiversity in New South Wales*, Technical Series no. 11, CRC for Australian Weed Management, Adelaide.

67 In 2011, the North Coast region had the second highest number of full-time council staff (24) and the highest number of part-time staff (7.4) responsible for weed management in NSW, based on data provided by the Noxious Weeds Advisory Committee.

Table 6: Introduced species recorded between September 2009 and September 2013

Botanical district	Number of introduced species recorded over four years
North Coast	51
Central Coast	31
Central Western Slopes	20
Southern Tablelands	20
North Western Slopes	14
South Western Plains	19
South Coast (includes Jervis Bay Territory)	14
Central Tablelands	13
Northern Tablelands	12
South-west Slopes	11
South Far Western Plains	7
North Western Plains	6
North Far Western Plains	5
Lord Howe Island	No records

3.3 The distribution and abundance of weeds

The distribution and abundance of weeds across NSW is influenced by a number of factors and must be monitored regularly in order to understand the scale of weed invasion, the effectiveness of eradication efforts and where management effort should be prioritised. It is beneficial to capture such change in real time as part of detection and surveillance programs. This information builds an understanding of the scale of weed invasion that can inform decision-making.

Availability of information on weed distribution and abundance

State-scale distribution and abundance maps are available from DPI for 142 weeds[68] but these maps have significant limitations in terms of coverage, reliability and accuracy. They are based on information collated from surveys of LCAs that scored the abundance and distribution of weeds in their respective areas, thereby capturing local knowledge of weed infestations for a particular point in time. [69]

In 2007-2008, 134 weeds were mapped. They included noxious weeds (listed under control classes 1, 2, 3 and 5), WoNS (including alert species) and 20 species identified as new and emerging threats by Regional Weeds Committees or from existing CMA weeds strategies.[70] The dataset was

[68] Distribution and abundance maps for priority weed species within NSW can be found on the NSW Department of Primary Industries website, at: dpi.nsw.gov.au/agriculture/pests-weeds/weeds/weed-maps/nsw-weed-maps (accessed 2 December 2013).

[69] The NRC attempted to acquire the metadata that underpins these maps. However, this information was not available. The metadata would provide clarity regarding the purpose of the dataset, its intended use, how it was created, data reliability, accuracy and limitations, when the dataset was published and by whom.

[70] Brindle, S. (2008), *Invasive species monitoring – local government weeds survey (2007-08)*, NSW Department of Primary Industries, Sydney.

subject to an expert panel review; however, weed presence for 123 of these weeds was not known for more than 50 per cent of the state.[71]

In 2010, 87 weeds were mapped, including 80 weeds that were mapped in 2007-2008 and seven new weeds.[72] There appears to be greater coverage of weed presence/absence in this dataset; however, the 2010 data was not subject to expert panel review.

These datasets represent the most current information on weed distribution and abundance at the state scale, but have limitations, particularly given the coarseness of the mapping and the absence of robust documentation that describes the datasets.[73] The datasets also do not include Class 4 declared weeds.

Furthermore, a comparison of this data with up-to-date occurrence records for WoNS demonstrates the need for regular updates of weed distribution and abundance mapping; the dataset should be dynamic. For example, as shown in Figure 4, occurrence records of a sagittaria (*Sagittaria platyphyla*) infestation in southern NSW indicate presence in areas where the distribution and abundance is categorised as 'absent' and 'unknown'. Distribution and abundance data therefore needs to be updated to reflect this information.

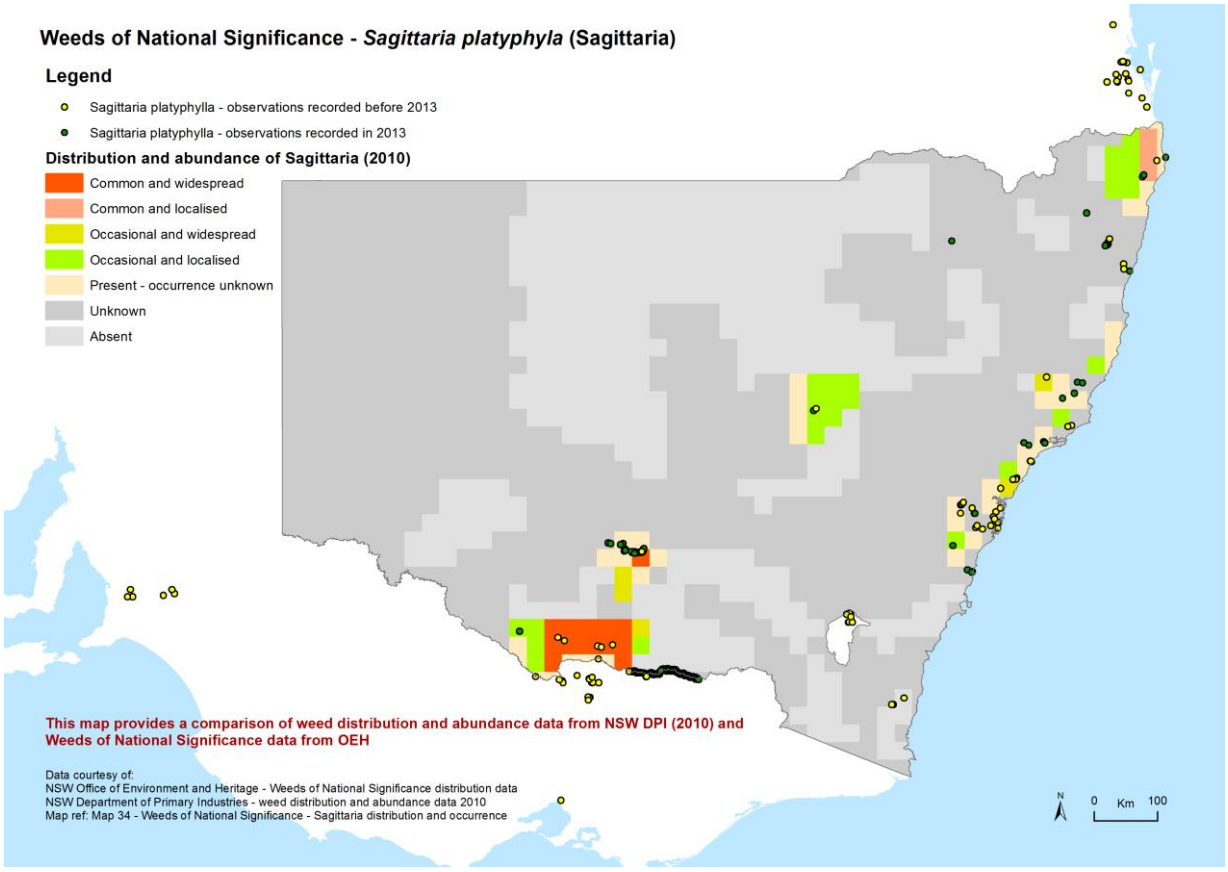

Figure 4: Comparison of observed records of Sagittaria with weed distribution and abundance

71 This statistic was derived from an analysis of the spatial data that underpins the weed distribution and abundance maps.

72 These species were added as they were new and emerging weeds that had become a priority - DPI, personal communication, 6 November 2011.

73 The mapping uses 50 kilometre grid cells. It cannot be assumed that the abundance category applied to a particular cell is homogenous across the entire cell. There is also no clear lineage for the dataset, i.e. metadata is not well documented.

Weed hotspots

While there are significant limitations to the datasets available from DPI, the NRC has developed maps of potential weed 'hotspots' in NSW overall and according to the themes of environment, production and human health as shown in Figure 5 to Figure 12. These maps are based on the 2007-2008 dataset described above. This dataset formed the basis of hotspot mapping in this report as it includes a larger number of weeds than the 2010 dataset and had undergone expert panel review.

Two different types of maps were developed. The first shows weed diversity based on the number of noxious weeds present in a given area. The second shows the severity of weed infestation. It is based on an abundance score of weed cover for a given area. Proportional weighting was applied according to the severity of infestation, as listed below:

- Where a weed was categorised as abundant (widespread) or abundant (localised), a cover abundance weighting of 75 per cent was applied.
- Where a weed was categorised as common (widespread) or common (localised), a cover abundance weighting of 30 per cent was applied.
- Where a weed was categorised as occasional (widespread) or occasional (localised), a cover abundance weighting of 5 per cent was applied.
- Where a weed was identified as being present but the density was unknown, the presence was not known or the weed was identified as being absent, a cover abundance weighting of 0 per cent was applied.

It is important to remember when viewing the weed hotspot maps that **weed distribution was reported as 'unknown' for more than 50 per cent of the state** for most of the weeds that have been mapped. This is particularly true in the western half of the state.

Four categories of weed hotspots were mapped:

- weed species that affect production, the environment, and human health (Figure 5 and Figure 6)
- environmental weeds (Figure 7 and Figure 8)
- production weeds (Figure 9 and Figure 10)
- weeds that affect human health (Figure 11 and Figure 12)

Table 7 summarises the location of hotpots for each category based on weed diversity and the weed abundance score.

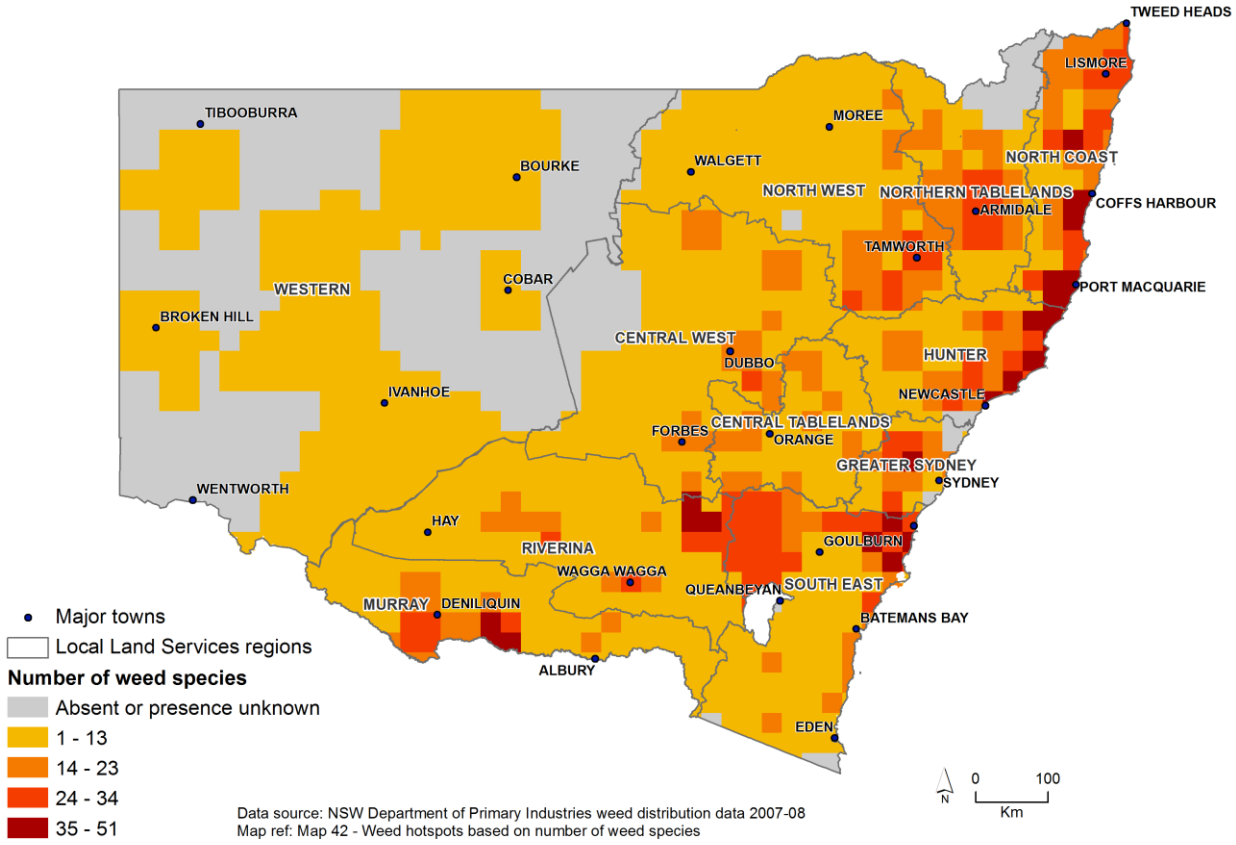

Figure 5: Weed hotspots based on weed diversity (number of weeds species)

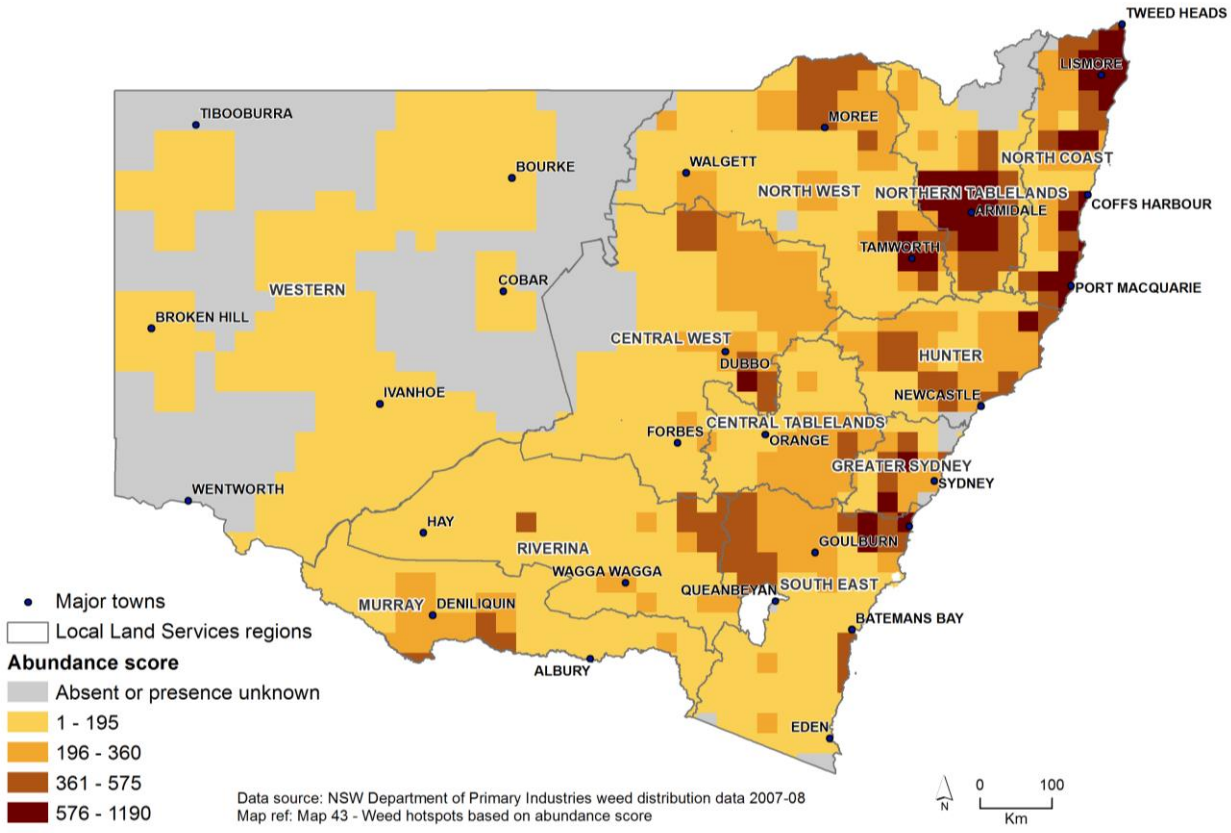

Figure 6: Weed hotspots based on weed abundance (aggregate score)

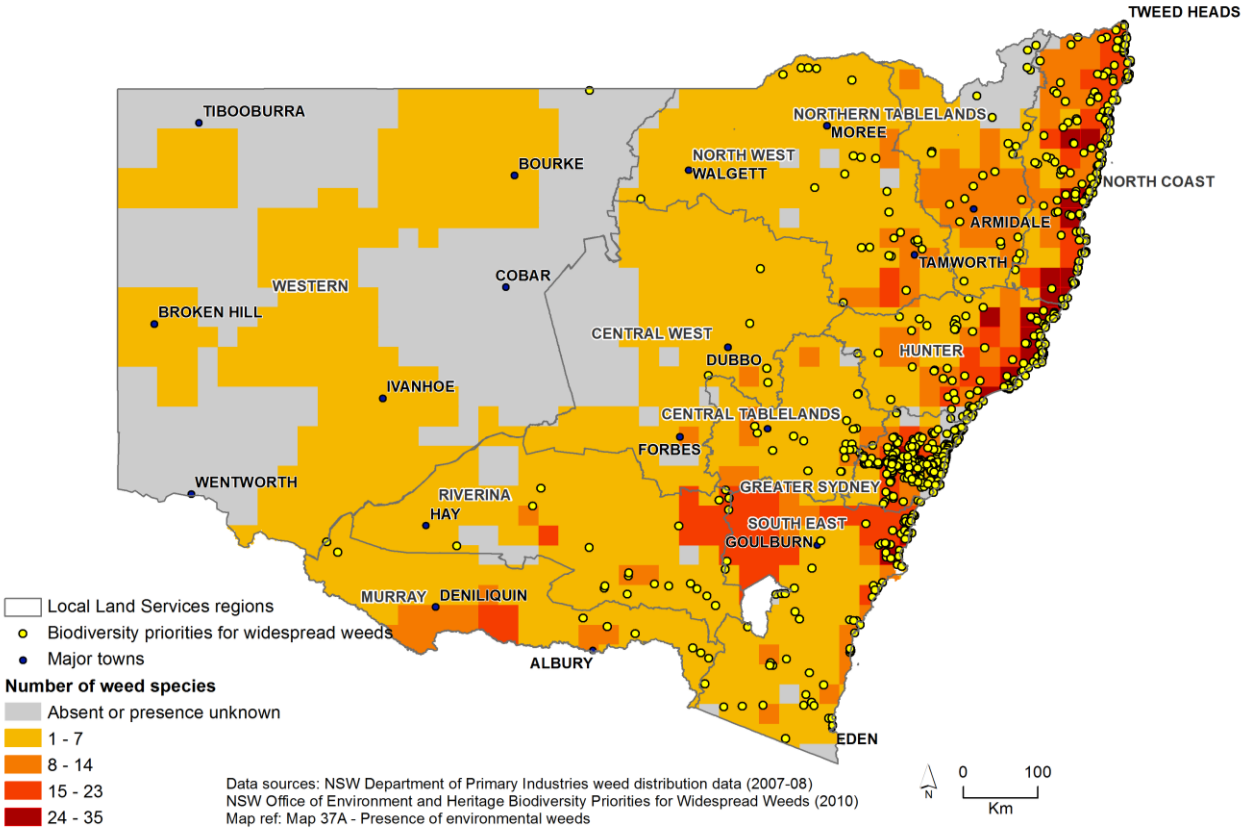

Figure 7: Environmental weed hotspots based on weed diversity (number of weeds present)

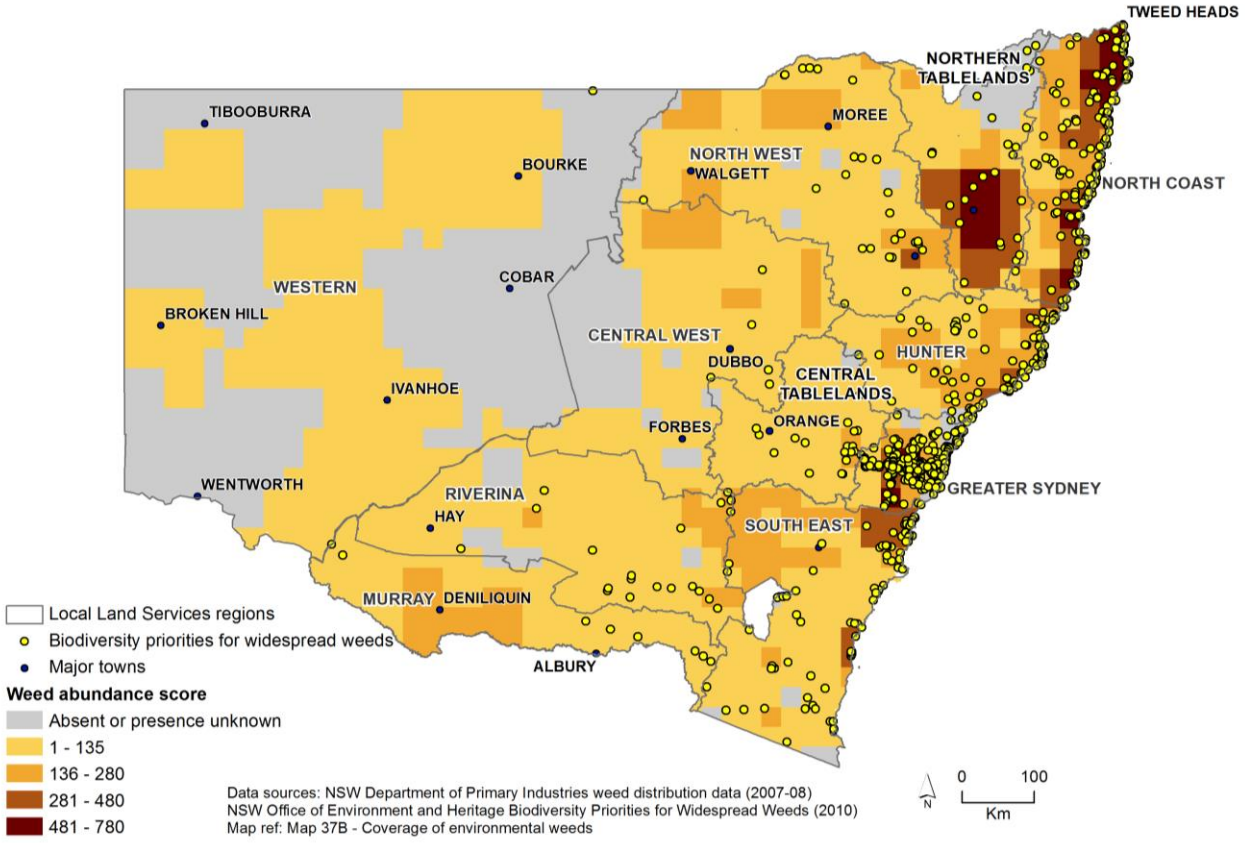

Figure 8: Environmental weed hotspots based on weed abundance (aggregate score)

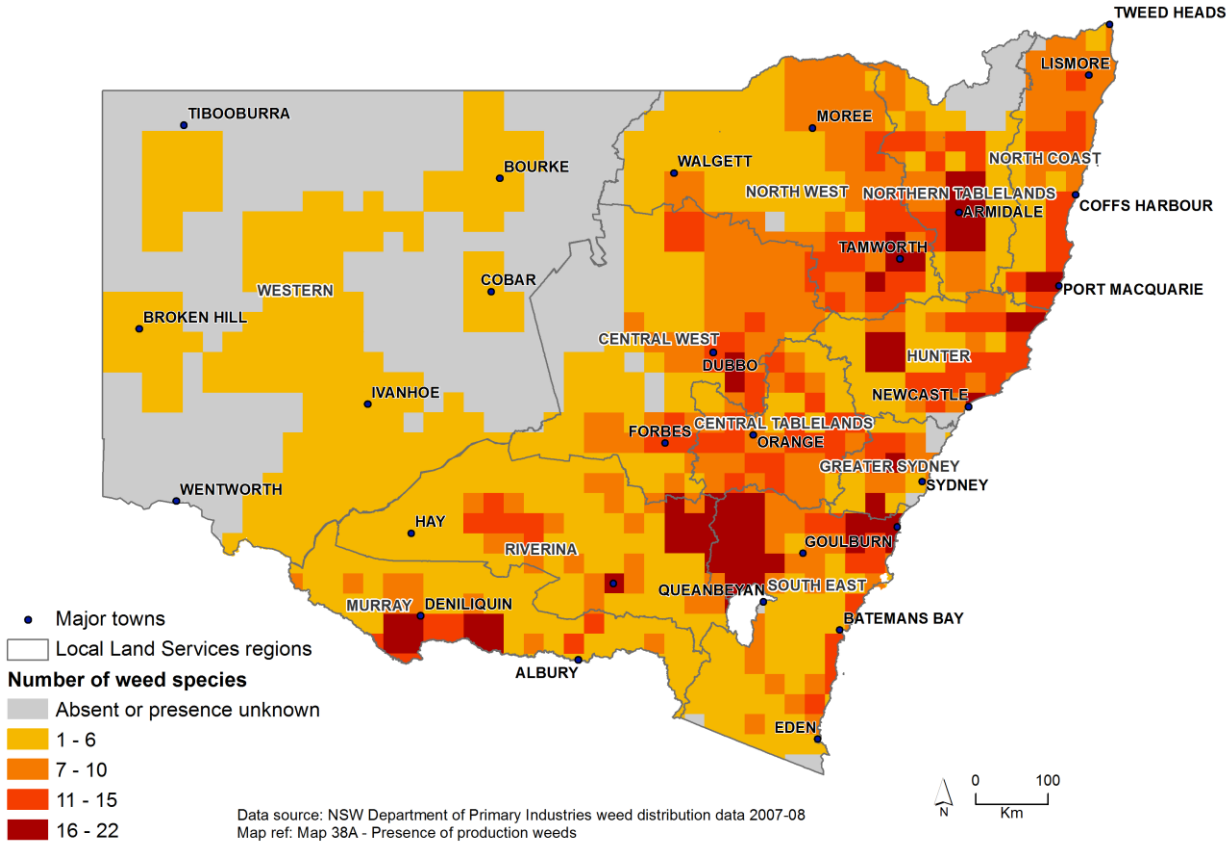

Figure 9: Production weed hotspots based on weed diversity (number of weeds present)

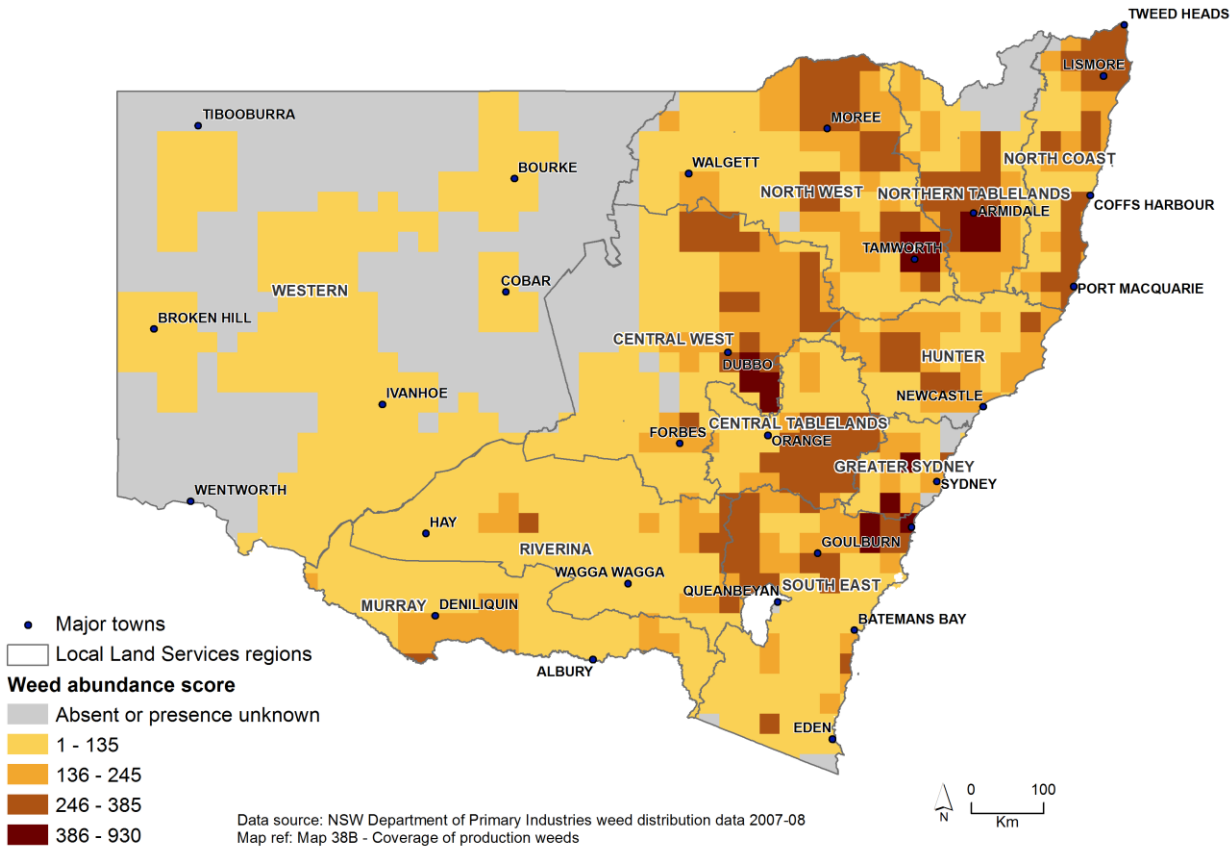

Figure 10: Production weed hotspots based on weed abundance (aggregate score)

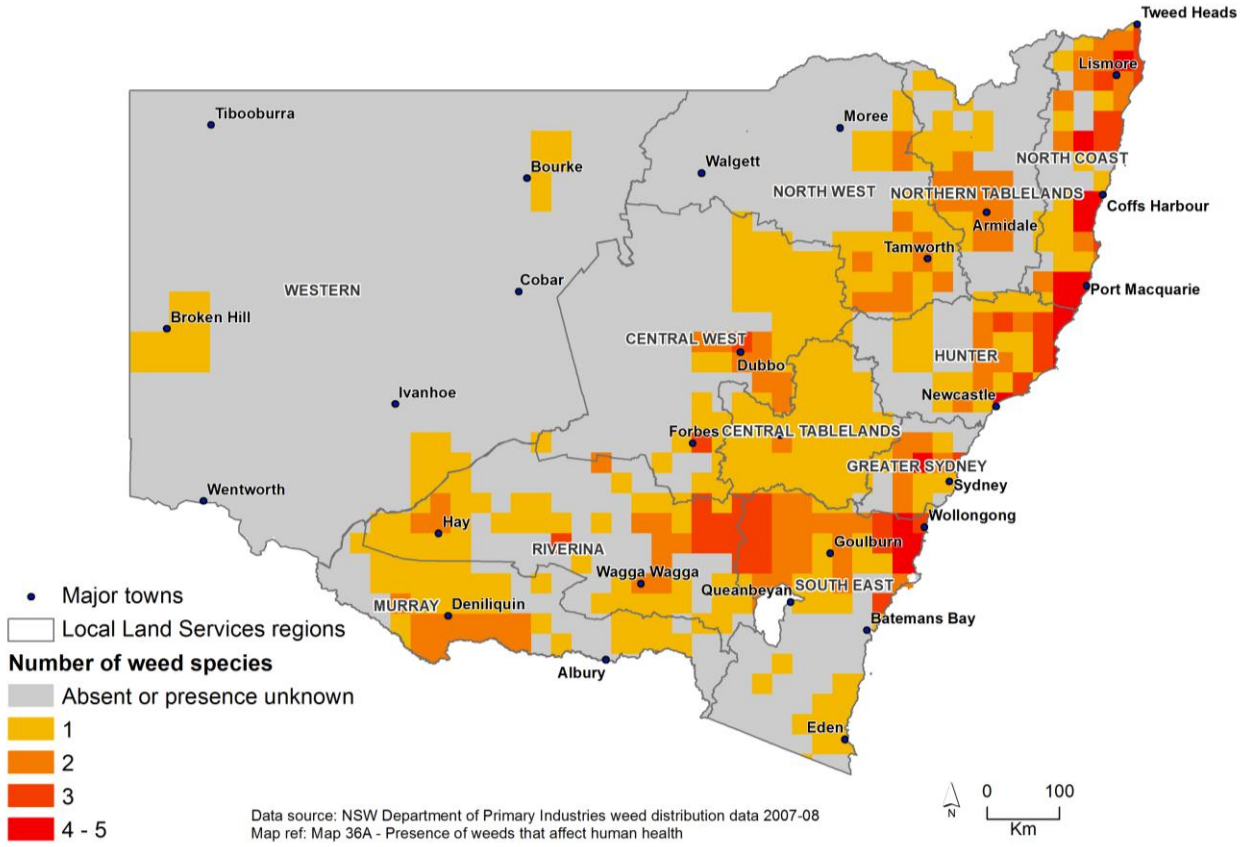

Figure 11: Weed hotspots for human health based on weed diversity (number of weeds present)

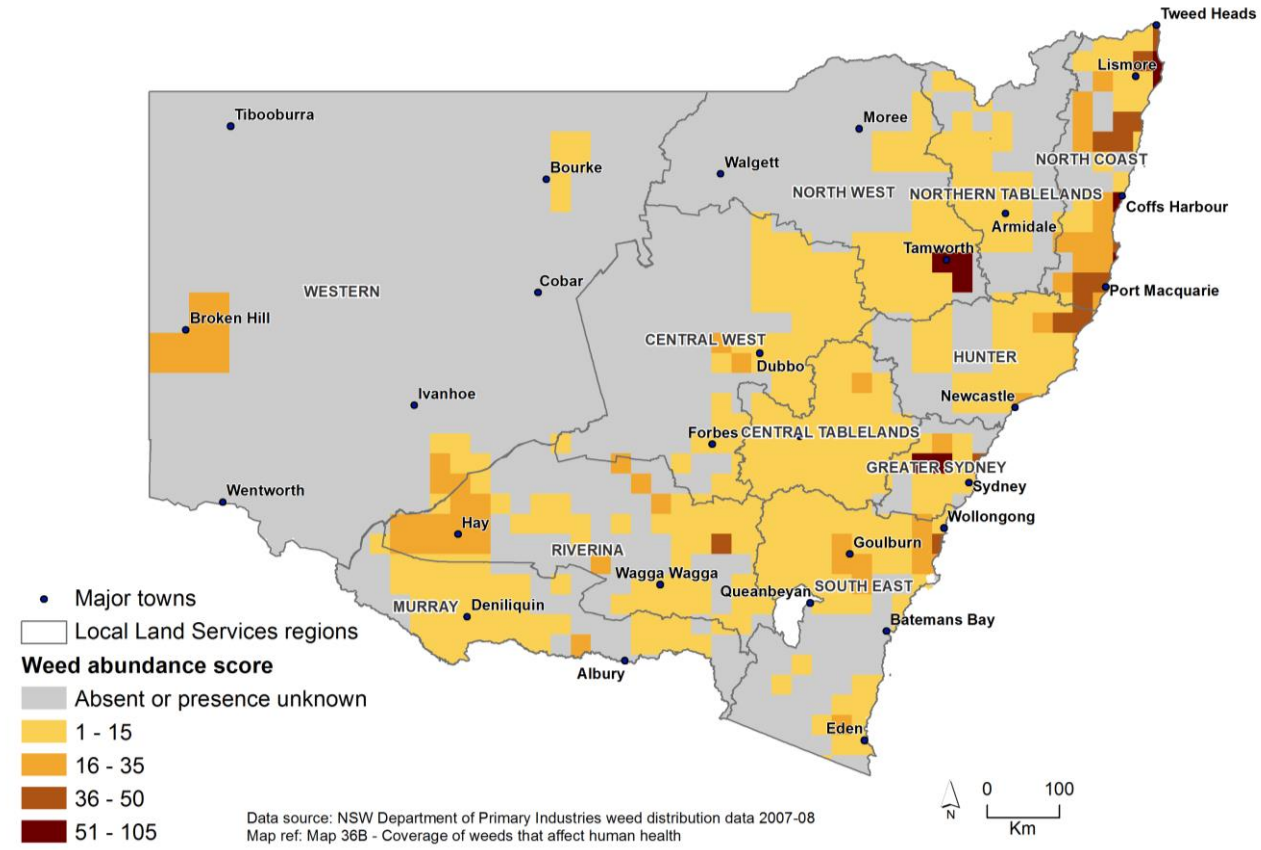

Figure 12: Weed hotspots for human health based on weed abundance (aggregate score)

Table 7: Weed hotspot mapping categories and results

Category	Number of weeds mapped	Location of hotspots based on weed diversity (number)	Location of hotspots based on weed abundance score
Weed species that affect production, the environment and human health (Figure 5 and Figure 6)	134	Weeds hotspots primarily occur along the coastal zone, but also around major regional centres. Areas with the greatest weed diversity (35 species or more) occur in six LLS regions including the North Coast, Hunter, Greater Sydney, South East and Murray.	The greatest areas of weed abundance occur in the Central West (south-east of Dubbo and south of Walgett), Greater Sydney, North Coast, Northern Tablelands, North West (to the north of Moree and around Tamworth). South East and concentrated areas of the Riverina and Murray.
Environmental weeds (Figure 7 and Figure 8)	95	The diversity of environmental weeds is greatest along the coast of NSW. There is a high degree of alignment between coastal areas with high weed diversity and biodiversity priorities for widespread weeds. Biodiversity priorities do not always align with weed hotspots because these priorities are based on asset protection (where there is a likelihood of achieving a positive biodiversity response).	The abundance of environmental weeds is greatest in the North Coast, the Northern Tablelands, Greater Sydney and South East LLS regions.
Production weeds (Figure 9 and Figure 10)	59	Production weed hotspots primarily occur along the slopes and tablelands near Armidale (the Northern Tablelands), Tamworth (the North West), the upper Hunter, far-eastern Riverina and the northwest of the South East LLS region. Hotspots also occur in the main cropping area of the Murray, nearby Deniliquin.	The greatest abundance of weeds that affect production is concentrated around Armidale (the Northern Tablelands), Tamworth (the North West), southeast of Dubbo (Central West) and to the west of Wollongong (the South East).
Weeds that affect human health (Figure 11 and Figure 12)	6	Weeds that are known to affect human health primarily occur around major cities and regional centres (areas with higher population densities).	The greatest abundance of weeds that affect human health is concentrated around Tamworth, along the North Coast and in the Greater Sydney LLS regions.

Local weed mapping

Up-to-date local scale mapping is available for some areas of NSW where infestations or incursions are detected, monitored and reported. For example, Tamworth Regional Council mapped recent records of an alligator weed infestation in the Peel River (Figure 13). Sharing of such real time information with neighbouring authorities and state agencies is critical given the main pathway for spread of this weed is water movement and it poses a threat to wetlands, rivers and irrigation systems downstream of the current infestation. This information is also critical for national coordination of management efforts as it is a WoNS. However, currently the availability of this type of data is limited, and often where it is available it is not shared across borders.[74]

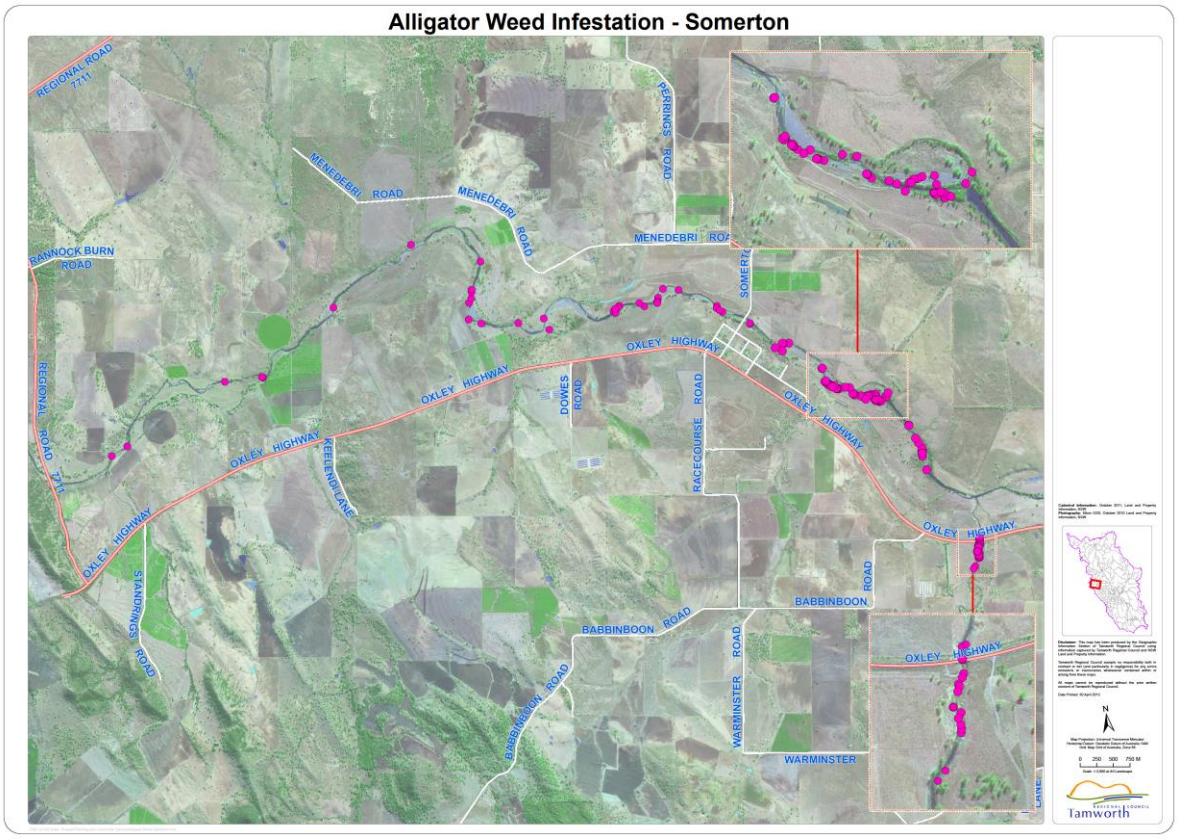

Figure 13: Alligator weed infestation recorded by Tamworth Regional Council

Weed data management systems

LCAs, weed management committees, state agencies and herbariums collect spatial information on weed distribution and abundance to varying degrees. This information is valuable for detecting changes in weed range and density, facilitating rapid response to new incursions and for informing strategic planning (prioritising surveillance and response efforts). However, there is currently no standardised approach for collecting and managing this information. Instead, each regional organisation has adopted a surveillance and response system that suits its individual needs. Example programs currently used on the ground by weeds officers include Weed Tr@cer and WeedMap Pro. While these programs enable weeds officers to record data on weed infestations, including their location and geographic trends, the benefits of collecting the data are diminished if they are not shared with stakeholders and used to evaluate outcomes and inform strategic planning.

74 For example, an area was identified where even though multiple LCAs in the region are using the same mapping program, they are not sharing data to create regional mapping.

Government agencies have adopted their own systems for managing the land for which they are responsible. For example, the NPWS has developed a Pest and Weed Information System so that it can report on the effort, costs, outputs and biodiversity outcomes of its pest and weed management programs.

The lack of a consistent approach to data capture and storage has hindered the ability to share information for effective and efficient weed management across the state and across borders. In addition, the absence of a centralised information management system that facilitates data sharing has compounded this issue.

Biosecurity NSW has initiated a trial of a central data portal - the Biosecurity Information System - to determine if it is a suitable platform for sharing weed identification and surveillance information. This trial is being undertaken in partnership with the Noxious Weeds Advisory Committee and the North Coast Weeds Advisory Committee, and includes the development of a metadata policy and data sharing agreements. Respondents indicated that it should be relatively simple to implement standard data protocols that the various systems currently in use could all use to allow for consistent state-wide data collection. Expediting agreement on standard metadata protocols and adoption of a state-wide data portal would help to address a number of issues. It would significantly improve weed management, particularly through the capture of real-time information, if key stakeholders commit to using the database and adopt associated standards and protocols.

3.4 Changes in weed distribution

Trend analysis is valuable in understanding how weed distribution and density has changed over time and to evaluate the progress of weed control programs. Trends in weed distribution and abundance are available for a limited number of species. This is partly due to detection and surveillance efforts and resourcing, but also because the technology that supports efficient detection of trends is relatively recent.

One exception is bitou bush, a WoNS, for which there is good data available regarding changes in distribution and density. Comparison of area and density changes in the core distribution of bitou bush demonstrated that the total area of land infested by the weed increased by approximately 20 per cent between 2001 and 2008. However, the density of infestations decreased substantially, with a 43 per cent reduction in infestations that had greater than 40 per cent cover (heavy density).[75]

Figure 14 illustrates areas where there has been an improvement in the density of bitou bush. Reduction in weed density was observed at a number of locations, including but not limited to Dunbogan, Port Stephens, Botany Bay and Jervis Bay. The containment lines for bitou bush were also modified to reflect control of the weed. These findings demonstrate the value of bitou bush control programs and reinforce the need for effective monitoring and evaluation programs across a broader range of weeds.

[75] Hamilton, M.A., Winkler, M.A., Cherry, H. and Downey, P.O. (2012), "Changes in the distribution and density of bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata* (DC.) (T.Norl.) in eastern Australia", *Plant Protection Quarterly*, 27(1): pp. 23-30.

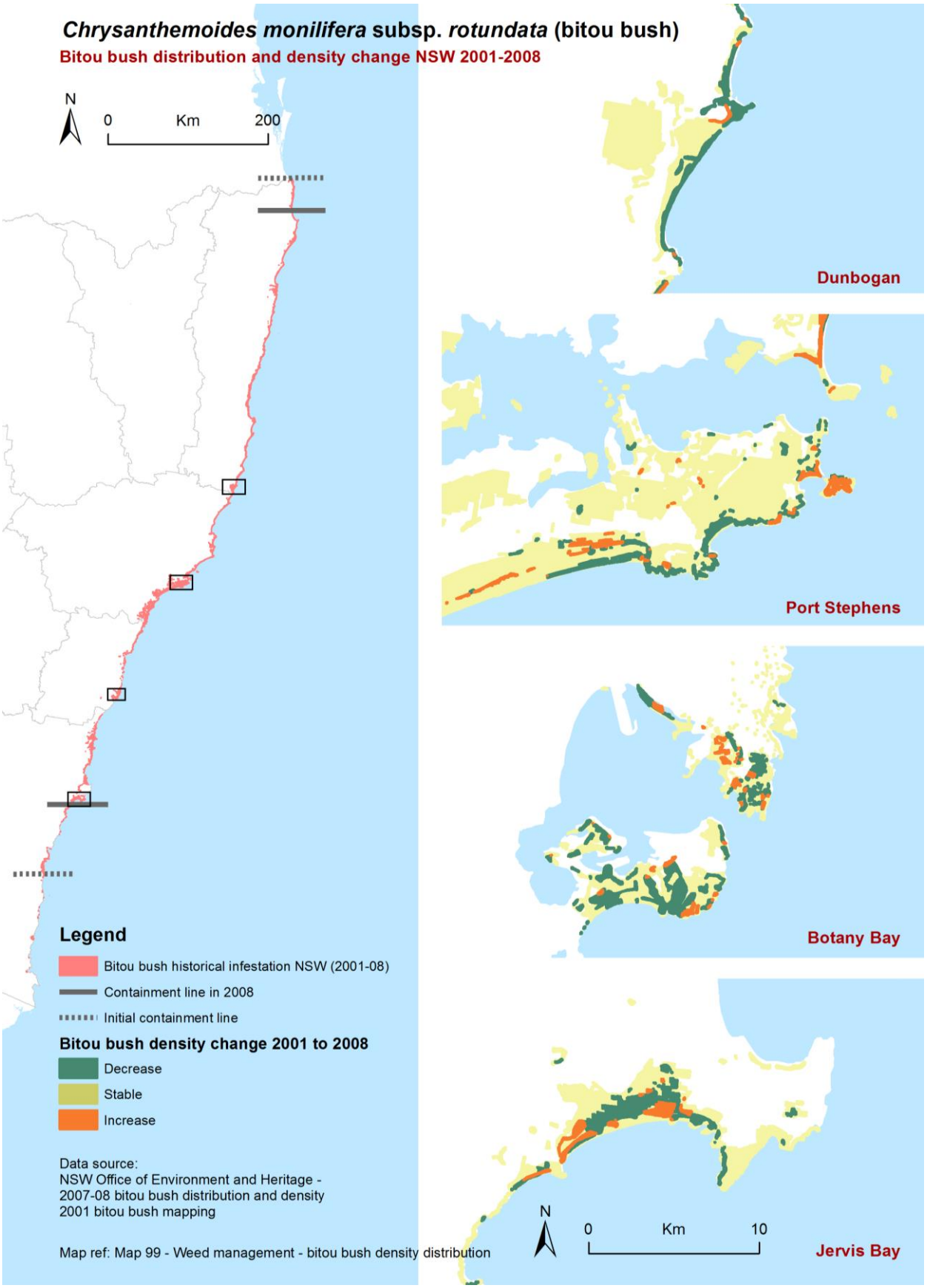

Figure 14: Change in the density and distribution of bitou bush between 2001 and 2008

Projected changes in climate suitability for weeds

Climate modelling by Australian academic and scientific institutions indicates that the south east and south west regions of Australia are most at risk from weeds, and that there will be a general shift southwards for most species.

CSIRO's modelling predicts that, under current and projected climatic conditions, the regions most at risk of incursions of weed on the national sleeper and alert lists[76] are in the south-east of Australia.[77] Weed displacement to the south could be in excess of 1,000 kilometres for wet tropical species, while displacement of coastal weeds will be restricted by landmass. Of the 41 weed species modelled by CSIRO, the two that pose the greatest threat of establishment are white weeping broom (*Retama raetum*), which is listed on the National Environmental Alert List[78] and fringed dodder (*Cuscuta suaveolens*), a parasitic plant that poses a threat to legumes and other crops.[79] These species have previously been recorded in NSW.[80] However, only one taxon, *Cuscuta* species, is declared as a notifiable weed in NSW.

Modelling of national priority weeds[81] by Macquarie University and OEH identified two potential invasion hotspots in Australia - the largest being in the nation's south-east (an area which covers approximately 340,000 square kilometres and includes NSW).[82] Projections for 2050 show the size of this hotspot reducing in size to 100,000 kilometres.[83]

The studies found that the current climate of the south east hotspot is suitable for 69 of the modelled species. The majority of these species have not reached their potential distribution under current climate conditions, and therefore their range and abundance has the potential to increase. For example, alligator weed is estimated to occupy less than 1 per cent of the range that it is capable of occupying in the Murray-Darling Basin.[84] Projections showed climate suitability declining to 64 species by 2020 and 58 species in 2050 as a result of increased temperatures, changed rainfall patterns and elevated carbon dioxide levels. Species predicted to see the greatest decline in overall climate suitability include alligator weed, Chilean needle grass and serrated tussock. However, the climate suitability of a number of species affecting northern Australia (and not yet listed in NSW) could expand southwards.

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76 Available at: environment.gov.au/biodiversity/invasive/weeds/weeds/lists/sleeper.html and environment.gov.au/biodiversity/invasive/weeds/weeds/lists/alert.html.

77 Scott, J.K., Batchelor, K.L., Ota, N. and Yeoh, P.B. (2008), *Modelling climate change impacts on sleeper and alert weeds: final report*, CSIRO Entomology, Wembley, Western Australia.

78 Department of Sustainability, Environment, Water, Population and Communities (2012), *National Environmental Alert List*, available at: environment.gov.au/biodiversity/invasive/weeds/weeds/lists/alert.html (accessed 2 December 2013).

79 *op.cit.* Scott *et al* (2008).

80 According to the Atlas of Living Australia records, available at: ala.org.au/ (accessed 15 November 2013).

81 Comprised of the original 20 WoNS, shortlisted WoNS, National Environmental Alert List weeds and four invasive grasses.

82 Wilson, P.D., Downey, P.O., Gallagher, R. V., O'Donnell, J., Leishman, M.R. and Hughes, L. (2011), *Modelling climate suitability for exotic plants in Australia under future climates: Final report on the potential impact of climate change on the distribution of national priority weeds in Australia*, Macquarie University and New South Wales Department of Environment, Climate Change and Water, Sydney, Australia.

83 O'Donnell, J., Gallagher, R. V., Wilson, P.D., Downey, P.O., Hughes, L. and Leishman, M.R. (2011), "Invasion hotspots for non-native plants in Australia under current and future climates", *Global Change Biology*: pp. 1–13.

84 Low, T. (2009), *Climate change and weeds and pests in the Murray-Darling Basin*, report prepared for the Murray-Darling Basin Authority.

In 2013, the National Climate Change Adaptation Research Facility published species distribution modelling, addressing how projected changes in climate may alter the patterns of naturalised, but not yet invasive non-native plants.[85] Individual species profiles were developed for 292 plants and hotspots of climatically suitable habitat were identified. The southerly coastal areas of Australia were found to have the highest risk of invasion, under both current and future climate scenarios.

Forty-one plants were assigned a high-risk of invasion for NSW under current climate conditions, and 36 were assigned a high-risk under future climate conditions. The modelled changes in plant distribution provide a powerful tool for NSW Government as they can be used to prioritise which naturalised plants should be targeted for weed risk assessment and potential future intervention.

3.5 Weed dispersal pathways

Plants have been introduced to Australia deliberately and unintentionally for a range of reasons and through a variety of pathways. Historically, the deliberate introduction of exotic plants occurred for economic gains (agricultural and livestock production, and horticulture) and aesthetic appeal in gardens (ornamental plant trade).[86] While introduced plants have increased plant diversity in Australia, they have also increased competition for resources and had adverse impacts.[87] Subsequently, a number of introduced species that were once valued for their economic and amenity values are now declared as agricultural and environmental weeds.[88]

Increased awareness of the threats posed by exotic plants entering Australia has led to considerable effort in understanding and managing associated risks.[89] However, there was historically limited understanding of the risks and pathways for weed spread once a species reached Australia. Hence, the NSW Weed Risk Management System was developed as a post-border risk assessment process to assess weed risk and the feasibility of coordinated control.

When growing conditions are suitable for weed establishment, there are no physical boundaries that prevent weed spread into new environments or neighbouring jurisdictions.[90] A comprehensive pathway risk analysis completed in 2008, identified 24 weed sources and 17 weed dispersal pathways in Australia[91] (Figure 15). The most significant weed sources identified by this study included: transport sites (roads, railways, ports, airports and water transport), land transitioning from one use to another (land in transition), pastures and rangelands, ornamental horticulture, private gardens and rivers.

The most significant pathways for weed spread included ornamental plant trade, and machinery and vehicle movements (accidental spread via passenger vehicles, farm equipment, boats and

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85 Hughes, L., Downey, P., Duursma, D.E., Gallagher, R., Johnson, S., Leishman, M., Roger, E., Smith, P. and Stel, J. (2013), *Prioritising naturalised species for threat assessment; developing a decision support tool for managers,* National Climate Change Adaptation Research Facility, Gold Coast.

86 Groves, R.H., Boden, K., and Lonsdale, W.M. (2005), *Jumping the garden fence: invasive garden plants in Australia and their environmental and agricultural impacts,* CSIRO report prepared for the World Wildlife Fund – Australia, Sydney.

87 Coutts – Smith, A.J. and Downey, P.O. (2006), *Impact of weeds on threatened biodiversity in New South Wales,* Technical Series no. 11. CRC for Australian Weed Management, Adelaide.

88 Cook, G.D. and Dias, L. (2006), "It was no accident: deliberate plant introductions by Australian government agencies during the 20th century", *Australian Journal of Botany,* 54: pp. 601 – 625.

89 Coleman, M.J., Sindel, B.M., Schneider, A.W. and Reeve, I. J. (2010), *Assessing weed spread in Australia using pathways risk analysis*, Proceedings of the 17th Australasian Weeds Conference, Christchurch, New Zealand.

90 Blackmore, P.J. and Johnson, S.B. (2012), *Continuing successful eradication of parthenium weed (Parthenium hysterophorus) from New South Wales, Australi*a, Proceedings of the 17th Australasian Weeds Conference, Christchurch, New Zealand.

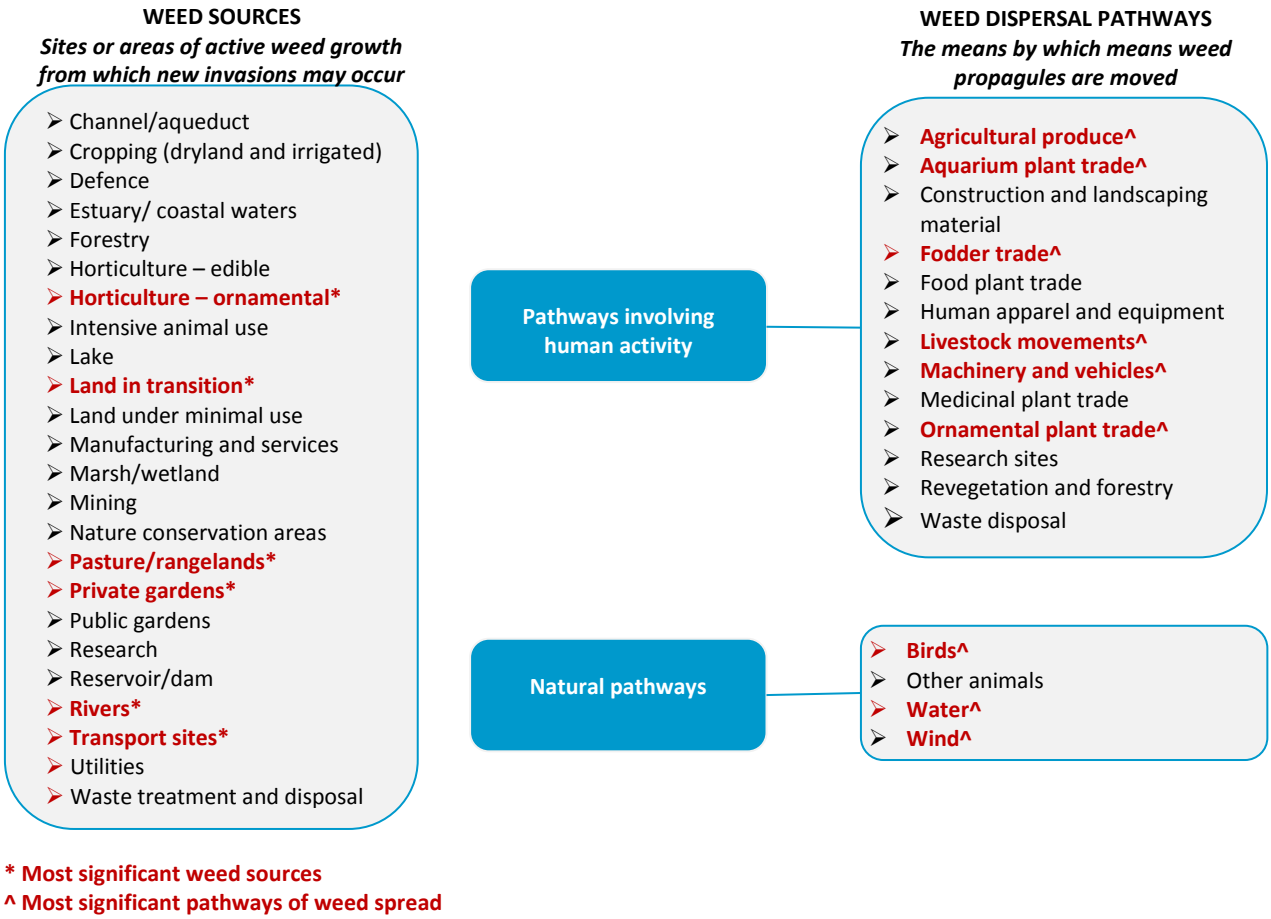
91 Sindel, B.M., van der Muelen, A., Coleman, M.J. and Reeve, I. J. (2010), *Pathway risk analysis for weed spread within Australia,* University of New England, Armidale.

earth moving equipment). Other weed pathways widely recognised in the study included the aquarium plant trade, fodder trade, contaminated agricultural produce, wind, water, birds and livestock movements.

Identification of the commercial (ornamental and aquarium) plant trade as an important weed pathway is consistent with other literature, which indicates that:

- garden plant introductions are the major source of new naturalised plants and weeds in Australia, accounting for 66 per cent of introduced plants that have established[92]
- the ornamental plant trade has contributed to the introduction of around 75 per cent of Australia's water weeds, including water hyacinth (*Eichhornia crassipes*) and salvinia.[93]

Linear reserves under public ownership such as transport and utility corridors, travelling stock routes, and other Crown lands are particularly significant weed pathways in NSW, and make up as much as 6 per cent of the state.[94]



*** Most significant weed sources**
^ Most significant pathways of weed spread

Figure 15: Sources and pathways for weeds spread (adapted from Sindel and Land and Water Australia 2009[95])

92 Groves, R.H., Boden. R., and Lonsdale, W.M. (2005), *Jumping the Garden Fence: Invasive garden plants in Australia and their environmental and agricultural impacts,* CSIRO report prepared for World Wildlife Fund-Australia, Sydney.

93 Petroeschevsky, A. (2007), *Reducing the water weed risk: how government and industry can contribute to a safer trade.* Nursery Papers, Technical, Issue 6. Nursery and Garden Industry Australia, Epping, NSW, available at: ngia.com.au/files/nurserypapers/NP_2007_06.pdf (accessed December 2013).

94 NSW Roadside Environment Committee, personal communication, 29 October 2013.

Knowledge of weed dispersal pathways is critical to weed management. For example, it has greatly contributed to the success of the NSW Parthenium weed program and preventing the establishment of this weed in NSW.[96] Parthenium is a WoNS that has been a high priority for NSW since 1976 due to the threat it poses to agricultural production and human health. Human-assisted weed spread was identified as the key vector for entry into NSW from Queensland where the weed has established. Natural vectors were historically considered a lower priority as the weed had not been recorded in the Murray-Darling Basin until recently.[97] A combination of measures has greatly assisted in managing the spread of this weed, including amendments to the *Noxious Weeds Act 1993* that require machinery wash-down, the set-up of clean-down sites at key border crossings, and end point inspections of machinery and livestock transport vehicles.

Some distribution modes will likely require greater focus due to climate change, in particular, fodder trade and natural water movements. Fodder trade to drought affected areas will likely increase, thereby heightening the risk of introducing fodder contaminated with weed seeds.[98] The importance of water as a natural pathway for weed dispersal will likely increase due to projected increases in climate variability (prolonged droughts followed by extreme floods).[99] The following are some changes that are likely to occur:

- Prolonged drought conditions will likely favour weed colonisation by reducing vegetation cover, providing increased area for weeds to colonise and increasing potential for flood runoff and weed seed dispersal when rain does fall.
- Reduced river flows could favour aquatic weeds that prefer stagnant water, such as water hyacinth. The floods that follow prolonged drought could spread plants and their seeds further downstream, enabling them to establish in new locations.

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95 Sindel, B.M., & Land and Water Australia (2009), *Pathway risk analysis for weed spread within Australia*, Land & Water Australia, Braddon, A.C.T.

96 Blackmore, P. (2011), *Parthenium weed in NSW – a model for continuing success*. Proceedings of the 16th NSW Weeds Conference, Coffs Harbour.

97 Parthenium weed was recently recorded in southern Queensland nearby rivers that form the headwaters of the Murray-Darling Basin that flow into NSW. Before these observations, NSW focused its efforts on managing the spread of the weed via human agents, however weed spread via natural water movements will likely become a priority in the future.

98 Sindel, B.M., van der Muelen, A., Coleman, M.J. and Reeve, I. J. (2008), *Pathway risk analysis for weed spread within Australia,* University of New England, Armidale.

99 Low, T. (2009), *Climate change and weeds and pests in the Murray-Darling Basin*, report prepared for the Murray-Darling Basin Authority.

4 Regulatory arrangements

Key findings:

- The current legislation include different responsibilities for public and private landholders, leading to inconsistent management across the landscape, and creating tension among landholders.
- Current legislation applies a similar command and control approach for incursions and widespread weeds. This is relatively effective for addressing incursions, but for widespread weeds can be counterproductive to shared responsibility, collective action responses, and adaptive management.
- Several specific areas of legislation and regulations should be improved. Many of these were identified as concerns in previous reviews, particularly the most recent review of the *Noxious Weeds Act 1993*, but were deferred for further assessment. These remain important areas to be addressed:
  - several high-risk pathways including fodder, commercial plant trade, and spread via waterways require stronger controls to mitigate risks
  - the weed declarations are currently fragmented and required controls are unclear; the process for declaration could be more transparent
  - the current enforcement mechanisms are insufficient to compel compliance
  - there is no requirement for notifying prospective land purchasers of a property's weed status, or to ensure the subdivision of land does not exacerbate weed problems
  - there are barriers to obtaining a minor use permit for an off-label herbicide use inhibiting response to new incursions.

4.1 Land manager obligations

Weeds spread across all tenures of land, do not recognise boundaries, and can only be successfully managed by consistent actions and cooperation of all parties across the landscape.

The *Noxious Weeds Act 1993* places different weed control responsibilities on private landholders and public authorities, other than LCAs. Private owners or occupiers of land are required to control noxious weeds on their land in accordance with a Weed Control Order. LCAs have the same responsibility for any land that they control. In contrast, other public authorities are required to control noxious weeds on their land only to the extent necessary to prevent weeds from spreading to adjoining land.[100]

Feedback from a range of stakeholders, as well as results of previous reviews, indicate that this differential treatment is seen by many as contributing to substandard weed management on some public land, and the imposition of unfair costs on private landholders. The NRC observed examples where different obligations and fragmented land tenure resulted in patchy and inefficient weed control efforts. Many public land managers implement minimal weed controls, and there is little enforcement of weed management requirements on public land. However, this is not true for all public land managers. For example, NPWS provides some good practice models for

[100] *Noxious Weeds Act 1993* (NSW) s 13.

public land management. Compared with most other public land managers, NPWS has a more proactive approach to weed management, as it aligns with their core business of biodiversity conservation. It has taken an integrated, risk-based approach to developing priorities in Regional Pest Management Strategies, and effectively works with volunteers to manage impacts on key assets.

In general, the public land managers consulted indicated they primarily focus weed management efforts on those actions consistent with meeting their land management objectives in the most practical, cost effective manner, and they had differing opinions regarding what is required to ensure weeds do not spread off their land.[101] Many public land managers have made efforts to build good relationships with private landholders that adjoin the land under their control, and to work jointly to control weeds on borders where neighbours have raised concerns. However, there is still a strong public perception that poorly managed public lands are a significant source of weeds.[102]

In general, public land managers consulted supported a landscape based approach to weed management.[103] However, they identified several potential barriers to a tenure-neutral approach which applies to public landholders the same obligations currently applied to private landholders:

- **configuration of land:** Public land managers are often responsible for large tracts of land that spread across regions. The Crown Land estate in particular is comprised of many small parcels of land distributed across the landscape making weed management difficult and expensive.
- **capacity concerns:** The capacity of public authorities to meet their weed management obligations varies considerably. Most retain a limited weed management capacity 'in house' and rely on the procurement of vegetation management services from contractors, who may not have the required skills for effective weed management.
- **cost implications:** Most of the public land managers raised concerns over the cost implications of increased responsibilities. Furthermore, they questioned the logic and cost effectiveness of having to control widespread weeds across their entire holding. For example, it would be inefficient to require a large public landholder to treat all of their land for a particular weed, when treating a buffer area around their property might mitigate impacts to them, their neighbours and the environment.
- **current governance arrangements:** Most indicated that the complexity of governance arrangements and weed control classes were major barriers to implementing a landscape approach. Some felt that punitive Weed Control Orders don't encourage co-operation.

[101] For instance, one public land manager indicated that they have requirements to wash down vehicles, and felt that is all that is required to meet their obligations. Others indicated that they perform some maintenance along borders with neighbours to create a buffer zone. OEH has a comprehensive strategic plan for managing pests including weeds, focused on protecting priority assets within the parks.

[102] This comment was made in many submissions to the NRC weed management review (2013), including: Primary Industries Ministerial Advisory Council, Clarence Valley Council and The Serrated Tussock Working Party for NSW & ACT.

[103] See Attachment 3 for a full list of public land managers consulted.

- **lack of engagement:** Many public land managers indicated that they were not adequately engaged in strategic pest management planning and therefore plans created often do not adequately cater to their operational requirements. Engagement of public land managers in RWACs is inconsistent across the state. Public land managers consistently indicated that while these groups are good forums for sharing information, they do not, for the most part, provide the strategic direction required. Most who do participate in these committees indicated that they are predominantly observers, with a few exceptions where LHPAs and NPWS are paying members and receive funding through the WAP.

Most public authorities have management systems in place that guide the operation of their business. Many of these management systems are subjected to external audit procedures to ensure that they meet specified outcomes. For example, the Forestry Corporation of NSW management systems are independently certified to the Australian Forestry Standard. Therefore, most public authorities indicated that auditing of weed management responsibilities could be implemented. Public land managers also typically undertake compliance risk assessments, and noted that clearer identification of legislative responsibilities would facilitate their incorporation into operational practice.

4.2 Effectiveness of regulation for widespread weeds

The current legislative approach to the management of both incursions and widespread weed infestations under the *Noxious Weeds Act 1993* is fundamentally the same. Landholders in a defined area are obligated to undertake activities in accordance with the control class of a declared weed species on land under their control.

This type of approach is consistent with the dominant tools and approaches used at the time the Act was written. Since that time DPI and LCAs have evolved weed management considerably through a range of policies and tools including the Biosecurity Strategy, the Invasive Species Plan, WAP and education and capacity-building. New legislation should continue this progression towards use of a broader range of more modern legislative and policy tools.

A legislated 'command and control' approach is relatively effective for weed incursions where time and centralised coordination are critical and the risks of further spread are acute. Regulation is an important mechanism to ensure everyone meets their responsibilities; however, the unsuitability of a 'command and control' approach to the regulation of widespread weeds in particular is evident in the persistence and distribution of weeds that have been the focus of government attention for more than a century.[104] This approach focuses attention on the symptoms, rather than causes of weed invasion, such as vegetation removal, land being used beyond its capacity and inappropriate herbicide use.[105] It can lead to indiscriminate spraying of weeds rather than long-term solutions such as improved pasture management and capacity-building.

Management of widespread weeds is a human behavioural challenge[106] as it requires the broad adoption of management strategies by different landholders across the landscape. If regulations are not flexible, they can inhibit trialling and experimentation necessary for adaptive management.

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104 Invasive Species Council, Australian Association of Bush Regenerators, Greening Australia, National Parks Association of NSW and Nature Conservation Council of NSW (2013) *Review of Weed Management in NSW*. Submission to the Natural Resources Commission, December 2013.

105 Southern Rivers Catchment Management Authority submission to the NRC weed management review (2013).

106 Martin, P., Verbeek, M., Rile, S., Bartel, R., and Le Gal, E. (2012), *Institutions to improve weed funding, strategy and outcomes: Research agenda,* RIRDC, Publication No. 12/091 Project No. PRJ-006906.

In fact, the continual threat of enforcement and government intervention can work counter to the establishment of the cooperative relationships on which collective action is based.[107] Regulation should be but one strategy supported by others focused on co-operative community action.[108] Management approaches should have a greater focus on the social aspects of landscape management and methods to motivate landholders to cooperate and reciprocate.

The need for an alternative approach in dealing with widespread weeds is evident in how weed officers carry out their jobs, and in LCA and DPI support for alternative solutions and capacity-building. In discussions with weed officers it was evident that their successes rely heavily on building cooperative responses within their local regions. In many regions, approximately one-third of the officers' time was spent on engagement and capacity-building with landholders. For this reason, many LCAs indicated that they do not strictly enforce requirements for some widespread weeds, where the requirements are seen to be unreasonable or unclear, but rather work with landholders to mitigate risks.

An example of a more adaptive approach was presented in the New England Weeds Authority LCA region where weed officers have assisted land managers in developing property management plans, which they can implement over time to demonstrate they are making progress in addressing widespread weed issues. New legislation should better support cooperative action and innovative and integrated solutions to widespread weeds.

4.3 Management of risk

A major concern for weed management is that the parties responsible for introducing the weeds are generally not held responsible for the costs associated with managing them. As more and more weeds have been introduced, costs have continued to increase for private and public landholders, particularly farmers for whom weeds can have considerable productivity impacts. Furthermore, impacts on the environment and community continue to grow.

The Independent Regulatory and Pricing Tribunal (IPART) review of the funding framework for LLS[109] indicates that costs should be assigned first to risk creators, followed by beneficiaries of mitigation efforts, and finally the taxpayer (public) where it is too difficult to define the creators or beneficiaries, or the general public is the beneficiary. This type of 'beneficiary' should not be confused with those who benefit from taking risk. For instance, nurseries may import a weedy species and gain economic benefits from its sale. If that plant escapes and infests farms causing negative impacts, the farmers become impact bearers. According to the IPART definition (used in the NSW Biosecurity Strategy), such farmers would become beneficiaries of any mitigation efforts.

[107] Graham, S. (2013) "Three cooperative pathways to solving a collective weed management problem" *Australasian Journal of Environmental Management*, 20.2, January.

[108] Thorpe, J. & Lynch, R., (1999) *The impact of the national weeds strategy on weed management within Australia.* Proceedings of the Twelfth Australian Weeds Conference Hobart, available at: caws.org.au/awc_contents.php?yr=1999

[109] Independent Pricing and Regulatory Tribunal of New South Wales (2013), *Draft Report - Review of funding framework for Local Land Services NSW*, available at: ipart.nsw.gov.au/Home/Industries/Other/Reviews/Land_Services/Review_of_a_funding_framework_for_Local_Land_Services_NSW/10_Sep_2013_-_Draft_Report/Draft_Report_-_Review_of_funding_framework_for_Local_Land_Services_NSW_-_September_2013 (accessed 2 December 2013)

Under the NSW *Noxious Weeds Act 1993* the following costs have been allocated:

- Landholders (private occupiers) are responsible for the costs associated with controlling weeds on their land, as required under the Weed Control Order.
- LCAs, as occupiers of land, are responsible for the costs associated with controlling weeds on the land, as well as on any road (other than a freeway, tollway or state work within the meaning of the *Roads Act 1993*) in the local area of the authority as required in an order. In this instance funds are sourced from public monies through rates (and in some instances levies).
- Public land managers are responsible for the costs associated with the control of noxious weeds on the land as required under the order, to the extent necessary to prevent the weeds from spreading to adjoining land. In this instance funds are sourced from public monies through taxes.

Governance of weed management could be improved if the parties responsible for the introduction or the spread of a weed are made accountable for the negative impacts incurred. Risk creators would therefore be made responsible through market-based and regulatory instruments. A 'polluter pays' model for recovering the cost of weed management has been advocated by a number of stakeholders, including the Invasive Species Council.[110] While this model would encourage parties responsible for weed introduction or escape to contribute towards weed eradication and control, there are several barriers to this approach:

- it would be challenging to quantify the environmental and social values that may be impacted by a weed[111]
- legacy issues make it difficult to adopt a risk creator/impactor pays model based on historical decisions[112]
- difficulties would arise in pinpointing the original source of a weed and ultimately who is responsible for its establishment in a new area[113]
- the risk creator may be too diffuse to incur the cost i.e. the role of the risk creator and/or their responsibility for the problem could be difficult to define[114]
- imposing a charge for the risk creation may not be cost-effective.[115]

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110 Invasive Species Council, Australian Association of Bush Regenerators, Greening Australia, National Parks Association of NSW and Nature Conservation Council of NSW (2013) *Review of Weed Management in NSW*. Submission to the Natural Resources Commission, December 2013.

111 Johnson, S.B. (2012), *Economic tools ≠ policy actions. Why benefit cost analyses are not a policy panacea for weedy, but commercially valuable plant species*. Proceedings of the Eighteenth Australasian Weeds Conference, Melbourne http://www.caws.org.au/awc_contents.php?yr=2012

112 Independent Pricing and Regulatory Tribunal of New South Wales (2013), *Draft Report - Review of funding framework for Local Land Services NSW*, available at: ipart.nsw.gov.au/Home/Industries/Other/Reviews/Land_Services/Review_of_a_funding_framework_for_Local_Land_Services_NSW/10_Sep_2013_-_Draft_Report/Draft_Report_-_Review_of_funding_framework_for_Local_Land_Services_NSW_-_September_2013 (accessed 2 December 2013)

113 Environment, Communications, Information Technology and the Arts Reference Committee (2004), *Turning Back the Tide: Invasive Species Challenge*, report on the regulation, control and management of invasive species and the *Environment Protection and Biodiversity Conservation Amendment (Invasive Species) Bill 2002* (Cwlth), The Senate, Commonwealth Government.

114 *op.cit.* IPART (2013).

115 *ibid.*

Despite the fact that risk creators cannot be held accountable for **all** risks regarding weeds, current regulations could be improved by providing mechanisms to better control risks in relation to high-risk pathways, particularly:

- the ornamental plant and aquarium industries
- fodder trade
- machinery movement
- spread via waterways, including spread of aquatic weeds.

Several stakeholders have also argued that small landholders are often not held accountable for their risks (particularly at the urban fringe). However, this is an issue of enforcement of the regulations, rather than the regulations themselves, which require all private landholders to comply with the *Noxious Weeds Act 1993*.

Improved regulation of risk pathways

Progress has been made in recent years to better mitigate risks associated with high-risk pathways. For example, the WAP requires each region to develop a plan identifying high-risk pathways and requirements for monitoring those pathways.

Other initiatives have been introduced to mitigate the weed risks posed by the ornamental plant trade including:

- public and industry education awareness programs such as the national *Grow Me Instead* program developed by the Nursery and Garden Industry Australia in partnership with the Australian Government[116]
- introduction of national plant labelling guidelines to standardise labelling and marketing material developed by the nursery industry, including dealing with potentially harmful plants.[117]

Ornamental plants /aquarium industry

Plant traders are required to comply with the *Noxious Weeds Act 1993;* however, they do not bear the full costs of risk created by their activities as demonstrated by the proportion of weeds that are escaped ornamentals and which are now costing landholders millions of dollars to control.

Stakeholder feedback and WAP documentation indicates that inspection of nurseries and aquariums by LCAs is highly variable across the state. Some stakeholders noted that inspection is difficult because there is currently no requirement for nurseries or aquariums to be registered, and therefore many may fall under the inspector's radar. It has also been noted that there is limited or no weed surveillance in some areas around Sydney where major plant trade is conducted via nurseries, farmers markets, and street sales in locations where there is limited or no weed surveillance. Risks would be reduced if nurseries, flower markets and other plant traders had to be registered, and surveillance and enforcement was improved.

[116] Nursery and Garden Industry Australia (2009), *Grow me instead – how the nursery industry is addressing the spread of invasive plants*. Nursery Papers, Issue 5, June 2009.

[117] Nursery and Garden Industry Australia (2013), *National Plant Labelling Guidelines,* Version 2, January 2013.

Fodder

Under the NSW *Noxious Weeds Act 1993* the transport or sale of fodder from land with notifiable weeds is prohibited. This applies to both private and public land managers. However, lack of monitoring and enforcement limits the effectiveness of this prohibition.[118] DPI advises hay importers to obtain a vendor declaration stating that none of the noxious weeds declared in NSW are on the property from which the hay was harvested[119], but the effectiveness of this approach is uncertain.[120]

The total value of hay production nationally was estimated at $1.6 billion in 2006-07. On average around 70 percent of fodder is used on the farm where it is produced, however there is an increasing trend in the volume of hay being traded.[121] Fodder is a nationally traded commodity and the industry is very informal, making it difficult to regulate as it includes both major players and minor participants for which fodder production is a sideline, rotational crop.

The fodder industry has a culture of vendor declaration of the pesticide and herbicide use in fodder production. This culture is driven by the impact of pesticide residue on market access in the meat industry. The industry has introduced a national voluntary vendor declaration system[122], which could be easily adapted to include details and declarations of weed risks.

Machinery

A recent amendment of the *Noxious Weeds Act 1993* that broadened requirements for cleaning of machinery/equipment from any state or territory should assist in managing the entry of weedy material into NSW.[123] Equipment is no longer confined to agricultural machinery, but now encompasses any machinery or equipment specified by Ministerial order. These amendments are timely given the growing reliance on machinery contractors in the agricultural sector.[124] Expanding the vehicle types covered by the legislation is also appropriate given the findings of a recent study into utility vehicles in south-east Queensland which found these vehicles are capable of distributing large numbers of viable weed seeds throughout the year.[125]

NSW weed officers report that wash-down of vehicles from Queensland has improved significantly with the installation of stations at key points on the border. However, similar protections are not applied at the Victorian or other borders mainly because of the typical southward migration of harvesters. Furthermore, consultation indicates that wash-down tends to focus only on farm machinery and that wash-down of other types of machinery may be necessary. The powers to inspect machinery as required to regulate seed movement should be retained in new legislation, and proactively enforced based on risk, for example, for new major projects.

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118 A high proportion of participants in a recent study (76.2 per cent) indicated that this trade is not sufficiently regulated - Sindel, B.M., van der Muelen, A., Coleman, M.J. and Reeve, I. J. (2010), *Pathway risk analysis for weed spread within Australia,* University of New England, Armidale.

119 DPI Factsheet Information on importing fodder into NSW. September 2011, www.industry.nsw.gov.au/publications

120 Australian Fodder Industry Association, personal communication, 16 October 2013.

121 Rural Industries Research and Development Corporation (2009). *The Australian Fodder Industry - An overview of production, use and trade*, Publication No. 09/001 Project No. PRJ-000806.

122 Australian Fodder Industry Association (AFIA) Fodder Care Domestic, available at: afia.org.au/index.php/fodder-care.

123 Johnson, S.B., Blackmore, P. J and Lisle, S.D. (2013), *Noxious Weeds Act 1993– Moving with the times: what does it mean for you?,* Proceedings of the 17th NSW Weeds Conference, Corowa, NSW.

124 Australian Bureau of Statistics (2013), *Motor vehicle census, Australia, 31 January 2013: 9309.0,* available at: abs.gov.au/ausstats/abs@.nsf/mf/9309.0/ (accessed 2 December 2013).

125 Khan, I., O'Donnell, C., Navie, S., George, D. and Adkins, S. (2012), "Weed seed spread by vehicles: a case study from Southeast Queensland, Australia", *Pakistan Journal of Weed Science Research*, 18: pp. 281-288.

Education programs should highlight the risks of contract machinery moving from site to site, and encourage farmers and others who hire contractors to require the wash down of machinery before arriving at their property.

Aquatic weeds and spread via waterways

Previous reviews raised concerns over the impact of current regulations on the effectiveness of aquatic weed management.[126] The effective control of weeds along waterways is critical as spread via water-flow and floods is a major risk pathway, the importance of which is projected to increase with the impacts of climate change.

Aquatic weed management is difficult and can be expensive. Specialised equipment and knowledge, which individual landholders may not have, is also required for managing aquatic weeds. The *Noxious Weeds Act 1993* places responsibility for the control of aquatic noxious weeds in waterways with the adjoining land occupier, who is responsible for the area up to the midpoint of the waterway adjacent to their land.[127] This diffusion of responsibility to thousands of disparate public and private landholders impedes effective management of aquatic weeds which can quickly spread. Furthermore, the mobility of aquatic weeds makes enforcing this responsibility difficult.

Management outcomes would be improved by the appropriate allocation and clarification of responsibilities for aquatic weed management.

4.4 Weed lists and declaration processes

Noxious weeds declarations in NSW

In NSW, weeds are declared as noxious under the *Noxious Weeds Act 1993*. The Minister has delegated the authority to declare noxious weeds under the *Noxious Weeds Act 1993* to the Director-General and the Executive Director of Biosecurity NSW. Proposals for new weed declarations are made regionally by LCAs to the Noxious Weed Advisory Committee, who make recommendations regarding weed orders. This ministerially appointed committee includes representatives from major stakeholders including NSW Farmers, OEH, the Nature Conservation Council, and CMAs. Proposed declarations are advertised and submissions considered before recommendations are made. However, the deliberations of the Noxious Weed Advisory Committee are not made public.

Two types of concerns have been raised in regards to the current system for listing weeds under the *Noxious Weeds Act 1993*. First are concerns over the risk assessment system itself, which can favour determination that a weed cannot be eradicated. Second are concerns over the deliberation process including the range of information considered, and the fact that the Noxious Weed Advisory Committee membership is based on stakeholder representation only.

126 NSW Department of Industry & Investment (2011), *Report on the Statutory Review of the Noxious Weeds Act 1993*, Department of Industry and Investment, Sydney.
127 *Noxious Weeds Act 1993* (NSW) s 17a.

The Committee decision regarding weed listing is informed by the NSW Weed Risk Management System, which is used to assess the risk created by a weed and the feasibility of coordinated control. The risk analysis is based on the national post-border weed risk assessment protocol, a well-supported national standard.[128]

Feasibility of controlling a weed species is assessed by considering:

- the persistence of the species
- its current distribution
- the cost of control.

As with all risk assessments, this process has several subjective inputs, relies on imperfect data and incorporates various assumptions. Consultation suggests that as a result, the present weed risk assessment process may support a move from eradication to ongoing management too quickly. This is undesirable as eradication is far more cost-effective that managing a weed once it is widespread. Given the high potential costs a precautionary approach is warranted.

While eradication can be expensive, particularly where an incursion is not quickly identified, there may still be a high return on investment for eradication. The current system evaluates the feasibility of eradication using available resources. The long-term impacts and costs of having a weed become widespread should be considered, relative to the eradication costs. In some cases, raising additional funds for eradication may be justified and ultimately cost effective.

Inputs into the risk assessment are intended to incorporate environmental, social and economic considerations. Several stakeholders have indicated that the assessment process focuses predominantly on economic considerations without due consideration of the impacts on the environment and community. Further, concerns have been raised that the risk assessment may be viewed as 'the answer', rather than as one input into a deliberative process. While there is currently an informal process through which DPI and LCAs deliberate risk assessment results, along with other information, this process is not formalised or transparent.

The deliberation process should include people with a broad range of skills, to ensure that environmental and social impacts, which are particularly difficult to value, are duly considered.

Other criticisms of the declaration process expressed in consultation and submissions included:

- **fragmented** – while weeds must be proposed to DPI at a regional level, listings are made by local control authority boundaries, with 126 local control authorities this has led to fragmented listings.
- **slow** – the time it takes to get a species listed can be too long, creating risks that the critical period for eradication may be lost.
- **lack of transparency** – there is a lack of understanding amongst stakeholders regarding how weed declaration decisions are made.
- **inconsistent** – the known distribution of weed species can be inconsistent with the areas where species are listed; and species are often listed in one local government area but not in adjacent council areas even though they may be present and causing similar impacts in both.

[128] NSW Department of Primary Industries 2009, available at: dpi.nsw.gov.au/__data/assets/pdf_file/0020/300881/nsw-weed-risk-management-system-form.pdf (accessed December 2013)

Some attribute the inconsistency of weed declarations across the state to the disincentive for LCAs to support the declaration of a weed if it is a considerable problem on LCA land and would therefore require significant investment by the local government.

Several stakeholders also noted that there can be a disincentive to having a weed declared, as it then becomes the landholder's responsibility and is no longer eligible for many government funding arrangements. Costs to control some incursions may be beyond the capacity of individual landholders, and there may be a broader community benefit to government intervention.

The Minister can make an emergency declaration but the emergency declaration is time limited. In some cases, the emergency declaration time period may not provide sufficient time for a determination of a permanent declaration status. This can leave a time gap in which the requirement for landholders to eradicate the weed cannot be enforced.

Permitted list

The *Noxious Weeds Act 1993* uses a prohibited list approach, which places prohibitions on any species on the list. Evidence indicates that prevention of the introduction of new weedy species into the state could potentially be improved. For instance, several new species are naturalising in NSW each year as described in Section 3.2.

There is ongoing debate as to whether the current approach of a prohibited list would be more or less effective than creation of a 'permitted list' whereby only plants on the list are allowed to be imported or sold within the state. A complementary prohibited list would identify plants that have not passed the risk assessment or that are already declared and prohibited.[129]

Increased awareness of the threats posed by exotic plants entering Australia has led to considerable effort in understanding and managing associated risks.[130] A 'permitted list' approach is currently established at the national scale, in Western Australia and in the Northern Territory for aquatic weeds. Any plant not on the list must first be assessed for potential risks. Once plants are already in the country, managing them becomes the responsibility of the states and territories. A recent bio-economic evaluation of Australia's risk assessment system found that it delivers positive net economic benefits, whilst achieving environmental outcomes.[131]

A permitted list system is more suited to national borders but can also be effective in countries like Australia where states have weed declaration responsibilities.[132] The porous borders between eastern Australian states could make the permitted list approach difficult to implement. In Western Australia, the system works effectively;[133] however, it is supported by comprehensive interstate quarantine measures.

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129 Csurhes, S., Randall, R., Goninon, C., Beilby, A., Johnson, S. and Weiss, J. (2006), *Turn the tap off before you mop up the spill: Exploring a permitted-list approach to regulations over the sale and interstate movement of potentially invasive plants in the States and Territories Australia*, Proceedings of the 15th Australian Weeds Conference.

130 Coleman, M.J., Sindel, B.M., Schneider, A.W. and Reeve, I. J. (2010), *Assessing weed spread in Australia using pathways risk analysis*, Proceeding of the 17th Australasian Weeds Conference, Christchurch, New Zealand.

131 Keller, R.P., Lodge, D.M. and Finnoff, D.C. (2007), *Risk Assessment for invasive species produces net bioeconomic benefits,* Proceedings of the National Academy of Sciences USA 104, pp. 203–207.

132 Wittenberg, R., Cock, M.J.W. (eds.) (2001). *Invasive Alien Species: A Toolkit of Best Prevention and Management Practices*, CAB International, Wallingford, Oxon, UK.

133 Office of the Auditor General Western Australian (2013), *Managing the Impact of Plant and Animal Pests: A State-wide Challenge*, Western Australian Auditor General's Report. Office of the Auditor Gneeral Western Australia, Perth. December 2013.

The costs and benefits of a permitted list approach have been considered[134] and were discussed in the 2011 review of the *Noxious Weeds Act 1993,* which concluded that a feasibility assessment and consultation be undertaken. Although the benefits of precautionary approaches are hard to quantify,[135] Lippia (*Phyla canescens*) provides an example of how costly an ornamental species can be. Sold as a low maintenance lawn plant, the weed is estimated to cost the grazing industry $38 million per year with an environmental cost estimated at $1.8 billion per year.[136]

A barrier to this approach is that interstate participation and cooperation is preferable. This is demonstrated by current inconsistencies between jurisdictions and between Australian Government and state law which have hindered effectiveness of current weed lists. For instance:

- some species may be legally traded within one jurisdiction, but not in another[137]
- plant seeds that are listed on Schedule 5 of the *Quarantine Proclamation 1998* are permitted into Australia under section 63 (importation of seeds), however they may be listed as noxious weeds in state legislation and banned from sale.

The declaration of native species as weeds

A native plant may be declared as a noxious weed under the *Noxious Weeds Act 1993* following the same process for declaring a non-native species. However, the Minister of the Environment must approve the declaration.

The Minister for the Environment is also responsible for listing native species as feral native species or invasive native species under the *Native Vegetation Act 2003*. These are native species that behave in a typical weed-like manner, impacting both environmental and economic values.[138] However, the *Native Vegetation Act 2003* has no legislative triggers, obligations or incentives to require a landholder to prevent invasive or feral native species spreading within existing areas, or into new areas.[139]

Under former native vegetation regulations, landholders needed approval from former CMAs to clear or treat invasive native species, whereas feral species could be cleared as a routine agriculture management activity (subject to specified conditions). Under the new *Native Vegetation Regulation 2013*, both feral and invasive native species can be cleared or treated as a routine agriculture management activity.

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134 Csurhes, S., Randall, R., Goninon, C., Beilby, A., Johnson, S. and Weiss, J. (2006), *Turn the tap off before you mop up the spill: Exploring a permitted-list approach to regulations over the sale and interstate movement of potentially invasive plants in the States and Territories Australia*, Proceedings of the 15th Australian Weeds Conference.

135 Daniel H. Cole (2012), *Reconciling Cost-Benefit Analysis with the Precautionary Principle,* http://www.regblog.org, March 5.

136 Invasive Species Council, Australian Association of Bush Regenerators, Greening Australia, National Parks Association of NSW and Nature Conservation Council of NSW (2013) *Review of Weed Management in NSW*. Submission to the Natural Resources Commission, December 2013.

137 Petroeschevsky, A. (2007), *Reducing the water weed risk: how government and industry can contribute to a safer trade*. Nursery Papers, Technical, Issue 6. Nursery and Garden Industry Australia, Epping, NSW, available at: ngia.com.au/files/nurserypapers/NP_2007_06.pdf (accessed 2 December 2013).

138 NSW Government (2006), *Managing invasive native scrub – info sheet no. 9*, available at environment.nsw.gov.au/resources/vegetation/nvinfosheet9.pdf (accessed 2 December 2014).

139 Natural Resources Commission (2012) *Listing Yellow Mimosa (Vachellia farnesiana) as a feral native species - Recommendations*. Natural Resources Commission, Sydney.

There are now greater opportunities for LLSs to provide a strategic and coordinated whole-of-landscape approach to weed management in their regions, for example, developing coordinated approaches with their communities and LCAs to control invasive and feral native species as routine agriculture management activities.

Conflict species

Many species introduced because of the benefits they can provide have the potential to be invasive. Common examples are radiata pine (*Pinus radiata*) and buffel grass (*Cenchrus ciliaris*). Such 'conflict species' create a considerable problem from a management perspective, requiring a clear and unbiased analysis of the costs and benefits of their use. For instance, in excess of 100 plant species that are grown for human foods and edible oils have naturalised in NSW. The benefits that come from the cultivation of most of these species are presumed to outweigh their management cost.[140] Given the increasing international focus on food security and Australia's role as a key food exporter, Australian growers and graziers are under pressure to increase production at least cost.[141] However, to remain economically viable, it is essential to have cost-effective weed control measures in place that minimise potential environmental, economic and social impacts and enable growers and graziers to continue production.

The management of the weed risk posed by commercial species was an issue considered in the 2011 review of the *Noxious Weeds Act 1993*, which indicated that there could be considerable advantage in having specific provisions in the Act for the management of conflict species. The report also indicated that providing a regulatory framework for managing conflict species will help protect the considerable investment of those currently cultivating conflict species. However, a means for addressing this issue through the Act was not identified and this issue was deferred for further investigation.

4.5 Enforcement mechanisms

In practice, weed officers are generally reluctant to use the enforcement provisions of legislation. The NRC was unable to identify accurate reports of how many notices and fines have been given by LCAs.

Consultation suggests that the enforcement mechanisms provided in the current legislation are ineffective. The penalties are insufficient to encourage compliance and mechanisms for undertaking control or compelling landholders to undertake control are costly and difficult to implement.

Penalties for non-compliance do not vary based on the degree or type of offence. The standard penalty for any violation is only $200. There is no difference in penalty, for instance, for the extent of weeds uncontrolled on a property. The fines are often significantly less than it would cost to meet the requirements of the Weed Control Order.

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[140] Johnson, S.B. (2012), "*Economic tools ≠ policy actions. Why benefit cost analyses are not a policy panacea for weedy, but commercially valuable plant species*," Proceedings of the 18th Australasian Weeds Conference, Melbourne, Australia. Available: http://www.caws.org.au/awc/2012/awc201211951.pdf.

[141] McFadyen, R.E.C. (2012), *Food security for a 9 billion population: More R & D for weed control will be critical*. Eighteenth Australasian Weeds Conference, Melbourne, Australia. Available: http://www.caws.org.au/awc/2012/awc201213061.pdf

Further, the requirements for compliance with an order allow the landholder to repeatedly delay action when delay can seriously jeopardise successful weed eradication. While due process needs to be followed, the current arrangements provide for unreasonable delay. The Act provides for circumstances where the control authority can enter land and undertake weed management at the expense of the landholder[142], but most LCAs do not have sufficient funds to undertake significant weed control first and recover the costs later.

The cost of prosecuting a landholder who refuses to comply can be high and generally prohibits LCAs from taking cases to court. Furthermore, evidence indicates that judges are often disinclined to give significant penalties to local landholders who may be in difficult financial situations, and control authorities are often unable to recover their costs. For example, in Tonkin v Cooma-Monaro Shire Council [2006] NSWCA 50 (7 April 2006) a landholder appealed against a ruling in favour of the local council requiring payment of recovery of costs ($113,482.13) incurred in carrying out weed removal (under s 26 of the *Noxious Weeds Act 1993*). The weed removal was undertaken by the council following inaction after the issuance of Weed Control Orders for removal of African lovegrass and serrated tussock. The appeal was granted leaving the council with the costs.[143]

4.6 Notification on sale or sub-division of property

Many submissions, as well as previous reviews have identified that transfer of land ownership and the subdivision of land can contribute to ineffective weed management.

There are two primary issues:

- where the sub-division of land passes weed management obligations to a greater number of land managers, often with lower capacity for weed management
- where prospective purchasers are unaware of the weed management obligations attached to the land being considered for purchase.

These two issues are of primary concern in peri-urban and coastal regions where the sub-division of land and land transfer is most prevalent. However, this is also becoming a greater issue in rural areas where sub-division is occurring to create 'life-style' blocks.

Some councils have found ways to address these issues. A Local Government's approval of sub-division applications can be made contingent on the reduction of the weed management risks to prospective purchasers. For example, Eurobodalla Shire Council has a standard condition of consent that requires that the applicant liaise with, and comply with requirements specified by, the council's Invasive Species Officer prior to issue of a subdivision certificate.[144]

The proposed NSW Planning Bill 2013, as with current legislation, provides for the provision of planning information certificates in relation to particular parcels of land, which must be given to all purchasers of property to notify them of certain information about the property they are buying.[145] Currently, such notifications do not include information about the property's weed status.

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142 *Noxious Weeds Act 1993* (NSW) s 20.

143 Martin, P. *et al* (2012) *Innovations in institutions to improve weed funding, strategy and outcomes: Research agenda*, Publication No. 12/091 Project No. PRJ-006906.

144 Eurobodalla Shire Council submission to the NRC weed management review (2013).

145 Division 11.3 of the NSW Planning Bill 2013.

Section 64 of the *Noxious Weeds Act 1993* allows Local Government, on request, to provide prospective purchasers with information regarding any outstanding weed control notices or money owed for weed control activities. Although this provides important information it does not provide the prospective purchaser with a clear understanding of the weed management obligations on the land.

4.7 Minor use permits

The use of herbicides is regulated under the *Agricultural and Veterinary Chemicals Code Act 1994*, which is administered by the Australian Pesticides and Veterinary Medicines Authority (APVMA). The law requires that all agricultural and veterinary chemical products sold in Australia be registered by APVMA. Registered products must only be used for purposes that are specified on the label.

Circumstances often arise where herbicides are required for unapproved uses, generally for incursions of new weeds. These off-label uses must be authorised by APVMA through a minor use or emergency permit. Stakeholders in consultation have criticised the process for obtaining minor use permits as being both too slow and expensive to support effective weed management, particularly in emergency situations. In 2009, the Productivity Commission found that the efficiency of the APVMA assessments could be improved by rectifying dysfunctional arrangements for low risk products and uses, and through the greater use of international assessment data.[146] The Commission also recommended that the costs of APVMA assessments be commensurate with risks, and the resolution of inter-jurisdictional inconsistencies.

[146] Productivity Commission (2008), Chemicals and Plastics Regulation, Research Report. Melbourne.

5 Organisational arrangements

Key findings:

- Local level service delivery is a strength of the current system and should be continued. Weed officers are generally dedicated, well-trained and have established a strong network. However, there is a lack of consistency in weed management across the state in regards to funding, performance, and planning.
- Recognising the importance of working across local boundaries, LCAs have already begun working together through a variety of regional arrangements. These provide a strong foundation upon which to build.
- Despite progress, the regional arrangements for weed management overall are confusing and inefficient. The complexity of these arrangements and lack of coordination between bodies and across borders has reduced the effectiveness of programs. Specific opportunities for improvement include:
  - reducing the number of regional planning bodies
  - improved governance arrangements
  - coordinating strategic planning
  - clarifying roles and responsibilities.
- Response to incursions would be better coordinated at the state scale, with sufficient funds readily obtainable for the duration of the response program.
- Research and development is poorly coordinated and underfunded. Weed managers are unsure where to go to find the latest information, and results of research are not being effectively disseminated to those on the ground. Improved institutional arrangements are needed to facilitate this sharing.

5.1 Current organisational arrangements

Section 2.4 provides an overview of institutional arrangements for weed management. Under the *Noxious Weed Act 1993*, DPI has state level responsibility for weed management. Many responsibilities including monitoring, surveillance, and enforcement are allocated to LCAs, of which there are 126.

The institutional arrangements for managing weeds within NSW are complex, particularly at a regional level where relevant organisations include: WAP project committees (made up predominantly of LCAs), CMAs (now LLS), RWACs, OEH, other public land managers, and community groups such as Landcare.

The boundaries of the different regional organisations are inconsistent (**Figure 16**). There are 13 WAP projects across the 14 RWAC regions, with different borders from the former CMAs and the new LLS regions, as demonstrated in the map below. There is significant overlap of plans and strategies, with some RWAC regions overlapping with up to four former-CMA regions, and containing up to three WAP project groups.

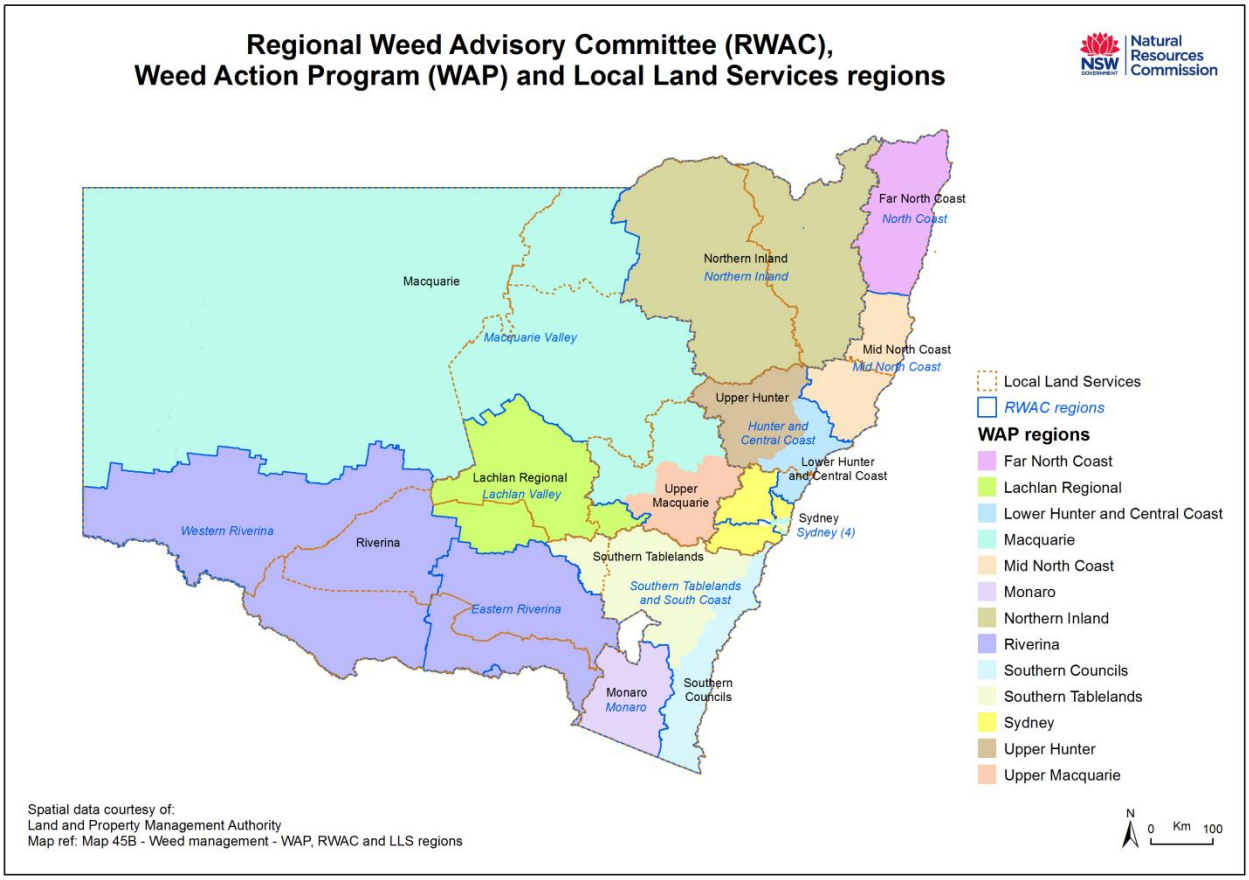


Figure 16: Boundaries of regional organisations

Most of the organisations at the regional level have a strategy or plan that identifies their priority weeds and directs their investment and/or activities. Each of the regional bodies has determined their priorities based on their own objectives, with limited coordination in areas where objectives are aligned. Research indicates that there are often 8 to 12 different plans covering areas within one LLS region. The number of different regional plans, and lack of coordination between many of them, indicate that current arrangements are inefficient and uncoordinated. The various types of plans are shown in Table 8.

Table 8: Plans for weed management in NSW

Organisation	Plans
Australian Government	Australian Weed Strategy Intergovernmental Agreement on Biosecurity
NSW	Biosecurity Strategy Invasive Species Plan
RWACs	Regional weed management plans
CMAs	Catchment Action Plans (broad strategic plans) Invasive species / weed management plans
WAP project teams	Required to prepare plans covering five topics – new incursions, high-risk pathways, rapid response, inspections and communications
OEH (in conjunction with CMAs)	Biodiversity priorities for widespread weeds Regional Pest Management Strategies (NPWS)
LCAs	Some have prepared local weed management plans (e.g. Blue Mountains Council Weed Management Plan) and some LCAs (particularly county councils) have a range of plans
Various	Weeds of National Significance Strategic Plans Weed specific management plans (e.g. Bitou Bush Threat Abatement Plan, NSW Tropical Soda Apple Plan, Macleay Catchment Tropical Soda Apple Control Plan)

Co-ordination between the regional organisations and awareness by organisation members of the varying plans was inconsistent. In some regions the various organisations (i.e. CMAs, WAP teams and RWACs) consulted each other in plan development. In others they were unaware of each other's plans, some bodies had aligned with each other but not others, or bodies were not cooperating across boundaries. The regional groups' awareness of, and coordination with, the OEH strategy (*Biodiversity Priorities for Widespread Weeds*) was also inconsistent.

There is also evidence that bodies are often not cooperating across boundaries. These concerns were raised for LCA, WAP project, CMA, and state boundaries. Several stakeholders provided examples where weed management actions stopped at a boundary with no coordination with the other side. Many also complained that they couldn't get cooperation from the other side of the boundary.

However, many of the regional bodies have made excellent progress in building relationships between LCAs and other partners. Several weed officers and public land managers indicated that the RWACs provide an important forum for sharing information. Most regional WAP project teams have developed various plans used by all LCAs in the region, improving consistency of management practices within their regions. Any future arrangements should build on such accomplishments.

5.2 Regional roles and responsibilities

Representatives from CMAs, WAP projects, and RWACs consistently expressed that there is a lack of clear roles and responsibilities at the regional level. For example, one respondent noted, "*Most people wouldn't be able to tell you who is in charge of weeds, but everyone agrees that it is an important issue*". Many were unable to articulate the role of the other groups, or provided different explanations for their roles than the organisations themselves described. In particular:

- The roles and responsibilities of the RWACs and the WAP project teams were not clear to many stakeholders. This is in part because their roles are not consistent across the state, with each having their own governance structure.
- Respondents from different regional organisations believed they were responsible for organising the same actions in that region. This was most evident in regards to response to new incursions, where roles and responsibilities are particularly unclear.
- CMAs provided widely differing responses as to their own role in weed management, with priorities ranging from only widespread weeds to only new incursions. Some CMAs indicated that they were 'prohibited' from investing in widespread weeds management due to funding arrangements. All agreed that they continued to experience huge demand to undertake weed management activities from their communities.

The lack of clear roles and responsibilities reduces efficiency and effectiveness of both response to new threats and management of widespread weeds. Many stakeholders expressed that weed management could be improved through more clearly defined roles, allowing each party to focus on their agreed responsibilities. This would also assist landholders to understand where and how to seek assistance when needed.

5.3 Local Control Authority responsibilities

Local service delivery is a key component of weed management in NSW. Many weed officers have built strong relationships with local landholders and have significant local knowledge. The state has established a weed officer certification program, to build weed officer skills and knowledge, and weed officers are, in general, highly professional and skilled workers.

However, LCA performance across the state is inconsistent. There is significant variation in amount of funding provided and number of staff dedicated to weed management. Some LCAs have no weed officer, even in high-risk areas. The plans for monitoring and surveillance were also found to vary in quality across the state (discussed further in Section 6.3). Currently there is no clear performance standard and no auditing program to ensure that LCAs are meeting their obligations.

There is a range of local arrangements for delivery of services under the *Noxious Weed Act 1993.* Types of LCAs include individual local councils, county councils and regional weed authorities. While examples of high performers for each type of arrangement were identified, no one particular governance arrangement was found to ensure high performance.

Economies of scale were observed where local councils have grouped themselves into a larger LCA. These groupings provide additional resources for training, equipment and working across council boundaries. County councils were found to have advantages in responding to incursions as they can quickly move staff across LCA borders when needed.

The NRC identified the following as indicators of good practice of high performing LCAs:

- sufficient size and resources to meet responsibilities
- clear and robust governance arrangements, with defined roles, responsibilities and objectives
- personnel with a range of skills including business management, capacity building and local weed expertise.

5.4 State level responsibilities

The recent release of the NSW Biosecurity Strategy, the creation of Biosecurity NSW and the integration of the weeds unit into Biosecurity NSW will allow the principles that are used in other areas of biosecurity, particularly that biosecurity is a shared responsibility, to be adopted and used for weed management.

DPI developed the Invasive Species Plan 2008-2015 with input from government, industry and the community. It is focused on exclusion and eradication of new incursions, effective management of established species and capacity-building. The plan provides a high level state-wide strategy for consistent management of all invasive species. Stakeholder feedback indicates that this plan has led to an improved understanding of strategic priorities across the state.

The WAP provides funds for service delivery, monitoring and surveillance, and capacity-building. While recent improvements have been made through the WAP, including the requirement to develop high-risk pathway plans, the NRC found that response to incursions in particular would benefit from greater co-ordination and oversight at the state level. Weed management staff frequently indicated that there is also a need to improve how responses to new and emerging weeds are funded.

Progress has been made through the creation of an incursion fund by DPI and the WAP, but further improvements are needed. An LCA or regional organisation can only apply for incursion funding for one year. LCA funds and activities are often reorganised to cover an incursion. This may be appropriate but often there are insufficient LCA funds to eradicate an incursion. For example in the recent tropical soda apple incursion, LCAs including the New England Weed Authority and the Mid-north Coast Weeds Co-ordinating Committee provided what funds and staff they could, Border Rivers-Gwydir CMA provided funds, and funds were acquired through the DPI incursion fund. However, the amount of funds and resources provided, and the time it took to acquire them, inhibited their ability to fully eradicate the incursion. Some LCAs have set aside emergency funds, but the requirement to spend their allocation within the WAP project time frame is a disincentive for them to do this.

The WAP is discussed further in Chapter 6.

Research and development

The increasing loss of weeds research capacity at both national and state levels has been a consistent theme of this review. There is additional concern that some capability, such as biological weed control, is at risk of being lost altogether. Communication of research findings has also been found to be insufficient, constraining knowledge and the implementation of new management strategies and technologies, and significantly reducing the return on weeds research investment.

Research and development concerns raised by stakeholders included:

- difficulty in securing long term funding
- increasing loss of capacity
- prioritisation of funding between emerging weed species and widespread weeds
- limited collaboration among practitioners (both government and landholders) and researchers
- poor dissemination of information
- slow uptake of new technologies.

An example of decreasing research capability is in biological control (biocontrol) staff numbers. In the late 1990s there were large and active biocontrol teams in all states[147] and federally in CSIRO, which cooperated and shared resources and information. There are no longer any biocontrol teams in Western Australia, South Australia or Tasmania. Victoria has two staff from ten remaining, Queensland two from six, and CSIRO staff in temperate Australia has been cut from twenty to three. Today NSW has three biocontrol scientists, no technical officers, no biocontrol officers funded through consolidated revenue and no biocontrol budget.[148] There are concerns that without sustainable funding in the next twelve months, the remaining national biocontrol infrastructure, such as plant quarantines and insectaries, will close. The implications of this are serious for Australian agriculture, particularly given the increase in herbicide resistant weeds, growing public concern about the use of pesticides and inadequate global investment in new chemistry.

Representatives from the various regional organisations indicated that there is poor coordination and dissemination of research and development, and that research is not well funded. Several indicated that they either rely on other organisations to be up to date, or that they would perform web searches and it was "sheer luck" if they happened upon the latest information. CMAs varied in where they obtained latest research with some having in-house expertise and others relying on other regional or local weed management staff for up to date information.

Examples were cited where different organisations were carrying out research on the same issue without coordinating or sharing, or where new techniques were unknown to weed managers. For example, in Western NSW weed officers were ground mapping weeds for several years while there was an industry project to map the same weeds using drone technology. There is a clear opportunity to improve coordination and dissemination of research and development.

The NRC did not find evidence of state-level strategies to indicate the highest research and development priorities. Consultation highlighted significant issues that have yet to receive research attention, such as treatment options for African Lovegrass. Yet, it is not clear how issues get on the state research agenda, or if there is one. Respondents also believed it would be helpful if there was some central repository for the latest research and development so that practitioners can quickly and easily identify the latest information and technologies in relation to particular weeds.

147 i.e. Western Australia, South Australia, Tasmania, Victoria, NSW and Queensland.
148 DPI, personal communication, 5 February 2014.

Between 1995 and 2012 the Australian Government funded the following major programs that specifically invested in weeds research and development:

- The Cooperative Research Centre (CRC) for Weed Management Systems, 1995-2005 ($15.4 million)
- The CRC for Australian Weed Management, 2001-2008 ($20.3 million)
- Defeating the Weed Menace R&D program, 2006-2008 ($5.4 million)
- The National Weeds and Productivity Research Program, 2009-2012 ($15.3 million).

The Australian Government also supported other large research and development programs such as Grain & Graze and Land, Water & Wool, which delivered integrated outcomes including weed management. The roll out of these programs attracted matching cash or in-kind contributions from program collaborators such as state governments, universities, Research and Development Corporations (RDCs) and landholders, effectively doubling the government investment.

Since 2012, government funding for weeds research has decreased and become more uncertain. Compounding this uncertainty, researchers are concerned that governments' current approach to weeds research lacks strategic direction, continuity and coordination. There is none of the long-term funding necessary to develop sustainable weed control strategies, and the available short-term funds frequently lead to inefficient projects with few tangible outcomes. In addition, the competitive nature of the funding constrains collaborative research effort.[149]

There has been continuing government investment in biosecurity research but only a small proportion of this goes to invasive weed species. The 2012 National Biosecurity Research and Development Capability Audit showed that of the $66,411,070 per annum spent on wages for staff across biosecurity research and development, 8 per cent ($5.5 million) was for invasive weed species (70.3 full time equivalents (FTEs)). Of the total capability, 48 per cent was classified as researchers, 45 per cent technical support while only 3 per cent and 4 per cent were postgraduate and postdoctoral researchers respectively.[150]

In early 2012, DPI had a total biosecurity research capability of 100.3 FTEs with 17.8 of these in invasive weed species, the highest capability of all research organisations other than Queensland Department of Agriculture Fisheries and Forestry.[151] However this included temporary employees. There are nine permanent weeds research staff currently in DPI, eight researchers and one technician.[152] In 2013 it was reported that similar to other states, there had been no new permanent DPI research officer/scientist appointments in weeds in over 20 years resulting in an aging, as well as a declining, capability. In addition to its alliance with Charles Sturt University in the Graham Centre for Agricultural Innovation, 2013-2014 weeds research funding in DPI is approximately $2.375 million which includes the $1.1 million WAP Innovation grants for research, development and extension and $1.275 million of external funds.

149 Australian Weeds Committee National workshop on collaborative weeds RD&E investment models, Canberra, 15 October 2013.

150 National Biosecurity Research and Development Capability Audit, Intergovernmental Agreement on Biosecurity – Research, Development and Extension Working Group, July 2012.

151 *ibid.*

152 DPI, personal communication, 5 February 2014.

The NRC notes that the NSW Biosecurity Strategy lists 'Strengthened biosecurity science and research capacity and capability' as one of its outcomes and specifically recognises weeds as an area needing greater emphasis, particularly investing in biological controls for key pests and weeds.

Biosecurity NSW has recently advertised a weeds research officer position and is working with other states, industry and the Commonwealth to develop a national research program to pull together the existing expertise and resources for weeds research. The aim is to develop a critical mass of research effort nationally, to refocus and to address combined government and industry priorities. A partnership approach is preferred so the Commonwealth, CSIRO, states, universities and industry RDCs can co-invest for joint benefits. This effort may result in a bid for a weeds CRC in 2015.

Despite the lack of major Australian Government funded weeds programs, other investors such as the industry based RDCs, have continued to fund weed management research. The largest of these, the Grains RDC, has maintained new investment in the order of $3 million to $6 million over the last six years. The NRC has requested, but not received, weeds research investment data from other RDCs but this is understood to be generally lower than Grains RDC, in some instances by an order of magnitude. By implication, research into weeds of grazing systems and environmental and aquatic weeds is relatively small. However, the NSW NPWS reports contributing between $120,000 and $200,000 per annum as cash and in-kind over the last three years to support a range of environmental weeds research projects.

Monitoring and evaluation are other important research related issues and require increased attention and investment. They are essential to provide information to:

- indicate if management actions are working[153]
- trigger new or changes to management action(s)[154]
- establish the cost-benefit of the research program.

Without effective monitoring programs there is no solid basis on which to assess, compare, understand or improve weed management and control. In a climate of decreasing weeds research capacity, monitoring and evaluation become essential to prioritising research and maximising the return on research funding.

Education and capacity-building

Many of the submissions emphasised the importance of awareness and education programs. Awareness and education programs take place at all scales and serve several purposes including: alerting the public to specific weeds, raising awareness of the serious impacts of weeds, and informing participants of their roles, responsibilities and methods for weed control.

Several good educational programs were highlighted in consultation and submissions including:

- the Southern Rivers Small Farmers Network program, which provided small farmers with targeted training and education on relevant local weeds, and developed an awareness program for priority weeds in cooperation with local councils.[155]

[153] Possingham, HP (2001), "The business of biodiversity: Applying decision theory principles to nature conservation. *Tela Series* No. 9, The Australian Conservation Foundation.

[154] Elzinga, CL., Salzer, DW., Willoughby, JW. (2001), "Measuring and monitoring plant populations", BLM Technical Reference 1730-1, U.S. Department of the Interior Bureau of Land Management, Colorado, USA.

[155] Southern Rivers Catchment Management Authority submission to the NRC weed management review (2013).

- the North Coast Weeds Advisory Committee Look Learn Act weeds awareness campaign, which provides information on how to identify and eradicate weeds. The campaign invites community members to participate by joining the Weed Spotters network and receiving regular updates and alerts on activities in the area.
- the DPI 'No Space 4 Weeds' program, which in 2011 included a roadside billboard campaign focused on informing the community about the risk of weed spread from gardening and recreational activities such as boating and camping.
- the weed officer certification/training program and regional weed advisory committees which help ensure knowledge sharing and ongoing training to ensure timely identification of new weeds.

The submissions also noted areas where education program could be improved including:

- better co-ordination of long-term programs
- focusing on a range of impacts and relaying goals, objectives and responsibilities
- ensuring programs are targeting the right audience
- better promotion of integrated land management practices.

6 Funding and program delivery

Key findings:

- Stakeholders indicate that the changes made through the WAP have improved surveillance, introduced standardised reporting of outputs and helped improve the standard of performance for many LCAs by clarifying responsibilities. Project officers have played a significant role in making the regional approach work.
- Current programs could be improved through better accountability and reporting on outcomes, rather than outputs, to demonstrate progress towards objectives. Examples of good practice for monitoring and outcome reporting should be built upon such as:
  - The bitou bush program has coordinated responses around shared goals and demonstrated clear outcomes of reduced density and movement of the containment line, providing a strong example for outcomes reporting.
  - CMAs often required long-term monitoring (over ten years) for projects which they have funded, including ongoing monitoring for new weeds where weed management was an aspect of a project.
- Community and volunteer programs deliver critical on-ground weed management and education. Successful projects include those that take a total farm management approach and build a sense of community ownership.
- Funding for weed management comes from a variety of uncoordinated sources at the Australian Government, state, regional and local levels. Evidence indicates that private landholders spend significantly more on weed management than governments.
- It is difficult to accurately quantify weed expenditure, in part because much weed management investment is integrated into broader land management projects. Additionally, many projects take place over several years, making it difficult to calculate and compare annual expenditure.
- Program funds are allocated based on multiple, often uncoordinated, strategic plans, resulting in a fragmented approach, and reducing administrative efficiency.
- Funding is currently too short-term, inhibiting integrated land management approaches, which would replace weeds with more desirable vegetation in the long-term.

This section details information gathered regarding the weed management activities funded in NSW. The NRC has attempted to determine the amount of funds provided over the past three years (from 2010-2013). Findings are followed by a discussion of the funding sources including: WAP, Catchment Action NSW, Caring for our Country, Biodiversity Fund, OEH, and Public Reserves Management Fund.

6.1 How much funding is provided and who provides it?

Weed management in NSW is funded through several sources including:

- LCAs funds – Local Government
- WAP funding – DPI
- Catchment Action NSW funding – NSW Government
- Caring for our Country – Australian Government
- Environmental Trust – NSW Government
- OEH /NPWS
- Public Reserves Management Fund
- Other public land managers (e.g. Forestry Corporation of NSW, LHPAs)
- Private landholders
- Community groups/volunteers.

Each of these funding sources has different objectives. It is difficult to determine the exact amount of money spent by each agency on weed management. Many of the funding streams such as Catchment Action NSW and Caring for our Country, allocate funds to natural resource management projects, which incorporate weed management into broader landscape restoration projects. As such, the NRC was unable to quantify a specific dollar amount, but has attempted to assess broadly the amount of funds allocated to weed management.

Table 9: Summary of funding information[156]

Funding provider	Summary of funding information
Farmers	It is estimated that NSW farmers spend approximately $810 million annually on weed management, based on Australian Bureau of Statistics data from 2007.[157]
LCAs	LCAs reported spending $45.5 million on weed management for the years 2010-2011 to 2012-2013, an average of $15.2 million annually.[158] This includes spending on meeting their own landholder requirements under the *Noxious Weed Act 1993*. A Local Government NSW survey of LCAs outside Sydney for the 2012-13 period indicated that councils provided $16,212,196 towards weed management activities, slightly higher than the values reported through WAP.
WAP	DPI provided $29 million through the WAP for the years 2010-2011 to 2012-2013, an average of $9.7 million annually.[159]
Catchment Action NSW	Nine of the eleven CMAs provided more than $2.7 million for projects focused on weed management from 2010-11 to 2012-13.[160] Additionally, a portion of approximately $74 million allocated to CMAs in this period was spent on integrated land management projects with a weed management component, but this could not be quantified.
Caring for our Country	The NRC identified $13 million of funding for Caring for our Country projects primarily focused on weed management funded from 2009-2010 through 2011-2012. Additionally a portion of the $141 million in base-level funding to CMAs and other competitive bid projects awarded in NSW over that time was spent on weed management – a specific value could not be determined.
Biodiversity Fund	The NRC identified Biodiversity Fund projects primarily focused on weed management totalling $8.6 million and an additional $30 million for projects with a significant weed component funded from 2010-2011 through 2013-2014, provided through two rounds of funding.
Environmental Trust	The Environmental Trust provided an estimated $10.3 million from 2010-2011 through 2012-2013 for weed management projects, an average of $3.4 million annually.[161]
NPWS	NPWS is estimated to have spent $54.7 million on weed management from 2010-2011 through 2012-2013, an average of $18 million annually.[162]
Public Reserves Management Fund	Crown Lands Division spent $585,000 to fund more than 166 weed management projects in 2011-2012.[163] It has been recommended that approximately $1.25 million be provided to fund more than 140 weed management projects in 2013-2014.[164]
Forestry Corporation of NSW	Forestry Corporation of NSW spent $1,018,984 on weed control in 2010-2011, over half of which was spent on treating blackberry.[165]

156 The NRC assessment focused on available records for the years 2010-11 to 2012-13 to correspond with data available from the WAP.
157 Australian Bureau of Statistics, Natural Resource Management on Australian Farms, 2006-07, released 25 Jun 2008. Table 2.2 WEEDS, Expenditure and Effort by state 2006–07 indicates NSW agribusiness expenditures of $475 million and 1,396,019 person days of effort. Assuming an eight hour day and $30 an hour for labour, this results in approximately $335 million annually for labour.
158 Figures taken from Weed Action Program annual reports provided to DPI by the regional project teams.
159 Data provided by DPI – annual Weed Action Program reporting, 1 November 2013.
160 Two CMAs were unable to provide data in time for this report.
161 Data provided by OEH, 2 October 2013.
162 Data provided by OEH, 2 October 2013 and 6 December 2013.
163 NSW Parliament Legislative Council General Purpose Standing Committee No. 5 (2013). *Management of public land in New South Wales*, NSW Parliament Legislative Council, Sydney, NSW
164 Data provided by Crown Lands Division of NSW Trade & Investment, 9 Dec 2013.
165 NSW Parliament Legislative Council General Purpose Standing Committee No. 5 (2013). *Management of public land in New South Wales*, NSW Parliament Legislative Council, Sydney, NSW

A considerable amount of weed management is also performed by volunteers through community groups such as Landcare, Bushcare, and other local conservation groups. The NRC has not attempted to determine the total value provided by volunteers and in-kind donations from community groups. However the following information provides some indication of the significance of these contributions.

- The Invasive Species Council estimates that the annual contribution of community organisations to weed management equates to approximately 569 full time volunteers and 900 full time paid staff, which can be valued at $28.4 million and $50 million of effort respectively.[166] This estimate is based on a 2013 survey of management effort on invasive species.
- NPWS indicated that a review of volunteer hours in parks for 2009-2010 found that approximately 43 per cent of all volunteer hours were spent on weed management, providing an estimated value of $1.3 million annually.[167]
- Estimates collected for the WoNS program indicate that community in-kind donations exceeded $500,000 annually for bitou bush and boneseed alone in 2009-2010.[168]

Landholders (particularly farmers) spend the most on weed management to improve productivity, meet their obligations under the *Noxious Weed Act 1993*, and protect biodiversity. Agricultural land makes up approximately 70 per cent of NSW.[169] However, based on available data it is likely that private landholders incur costs five to ten times the funds provided by governments for weed management, with additional significant contributions being made by volunteers and community organisations. This is without consideration of the substantial losses in productivity due to weed infestations. Private landholder and volunteer efforts are predominantly focused on control of what are now widespread weeds, demonstrating the enormous cost of the failure to prevent incursions.

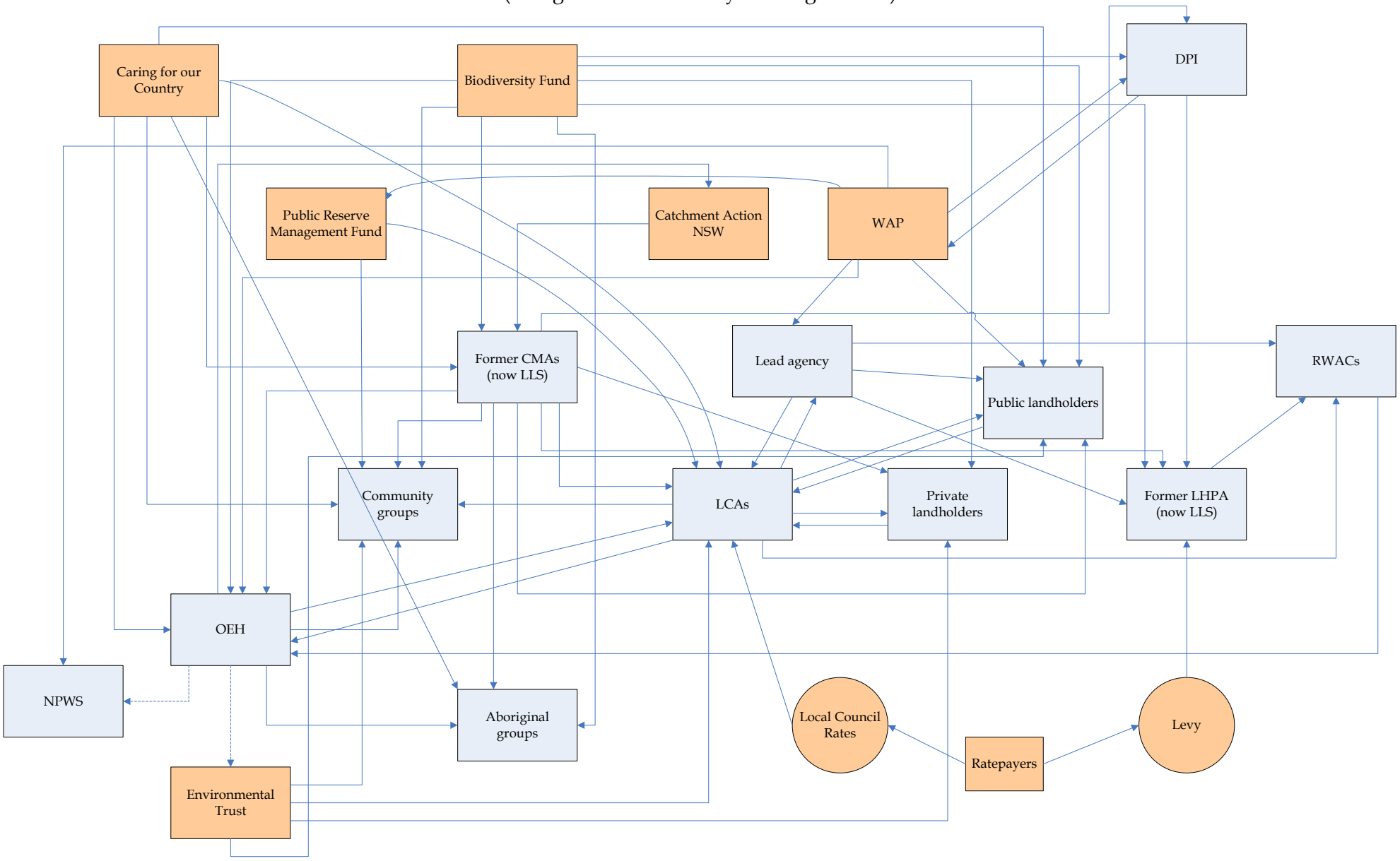
6.2 Coordination of funds

Funding for each weed management organisation is managed separately and the allocation of funds appears to be inefficient, with funding in some cases flowing back and forth between two entities. The diagram on the following page (**Figure 17**) illustrates the complexity of funding sources and recipients. The complicated funding and institutional arrangements create significant administration costs, reduce clarity of roles and responsibilities, and limit the potential for coordinated action across landscapes.

Many respondents noted that as several programs are moving towards competitive grants, weed funding is becoming more short-term and fragmented. Long-term funds are essential for both garnering broad stakeholder support, and for supporting integrated land management practices that will have greater benefits in the longer term than temporary killing of weeds by spraying alone.

166 Invasive Species Council submission to the NRC Weed Management Review (2013).
167 NPWS, personal communication, 6 December 2013.
168 Weeds of National Significance National Coordinator, personal communication, 6 December 2013.
169 NSW Department of Primary Industries (2013), *Growing the partnership of industry and government: agricultural industry action plan – issues paper*, , available at: dpi.nsw.gov.au/__data/assets/pdf_file/0004/468292/agriculture-industry-action-plan-issues-paper.pdf. (accessed 1 February 2014)

Figure 17: Flow of funds for weed management in NSW
(orange boxes denote key funding sources)



6.3 Weed Action Program / Local Control Authority funding

WAP provides state funding for management of weeds under the *Noxious Weeds Act 1993.* In 2010, DPI developed WAP, to replace and streamline a range of previous funding programs. The program provides funds to regional projects as well as for state-wide projects and 'innovation projects'. Its aim is to align weed management activities with the goals of the Invasive Species Plan.[170] In particular, WAP targets Goals 1, 2 and 4 related to excluding new weeds from entering NSW, eradicating new and emerging species, and capacity building. This shift was to ensure that DPI funds are targeting the most cost effective actions. Prevention of incursions has far greater return on investment than dealing with a widespread weed.[171]

Funding for LCA activities is provided by local councils, and is therefore funded predominantly through local council rates. LCAs provide funding for their landholder responsibilities, as well as compliance and inspection duties, and extension services they provide. Under the WAP there is no specific requirement for the amount of co-contributions. The funding guidelines state that "*Local weed control authorities, public authorities and other partners need to contribute to the projects to receive NSW Weeds Action Program (WAP) funding. There is no set contribution; however the priority will be to support projects with substantial contribution by local authorities and other stakeholders*."[172] Co-contribution commitments are negotiated at the WAP project level and included in the WAP applications.

The NRC has evaluated activities funded by WAP through review of the WAP Annual Reports, WAP Guidelines, documentation provided for each region by the project officers, and interviews with DPI staff, regional project officers, local weed officers, and representatives of other organisations such as CMAs and OEH. Activities and outcomes were assessed relative to stated objectives.

Weed Action Program funding allocation

Data was received from four of the regions regarding both WAP funding and co-contributions for individual LCAs.[173] This data demonstrates that co-contributions vary across the state. Individual LCA co-contributions as a percentage of the WAP funding within those regions ranged from 14 per cent to 394 per cent, with the majority of LCAs at least matching the WAP funding. While some variance may be appropriate, such differences should be justified and based on a clear assessment of risks.

It is understood that DPI historically allocated funding directly to LCAs based on analysis of factors such as population, land area, and weed risk used to assess how many weed officers would be needed in each area. Funding for regional projects was also provided.

170 NSW Department of Primary Industries (2010), *NSW Weed Action Program Guidelines*, available at: dpi.nsw.gov.au, (accessed 15 November 2013).
171 NSW Department of Primary Industries (2010), *2010-2015 Invasive Species Plan,* available at: dpi.nsw.gov.au, (accessed 15 November 2013).
172 NSW Department of Primary Industries (2010), *NSW Weed Action Program Guidelines*, available at: dpi.nsw.gov.au, (accessed 15 November 2013).
173 Data was provided by Regional project officers with permission of the local councils in the region.

Under current arrangements WAP funding is distributed to 13 regional projects via a 'lead agency'. The previous government instructed DPI to allocate WAP funding to regional areas on the basis of the historical distribution of funds plus CPI, including the noxious weed grants and regional project funding provided for 2008-2009. Most regions understood this to mean that each LCA should continue to receive what they had received previously. As such, all but one WAP region distributes funds to individual LCAs based on historical allocations. Strategic allocation of WAP funds can be improved by considering up to date assessments of greatest needs and risks.

Each region, except Upper Macquarie, employs a project officer to coordinate the program. In most cases this person is a representative of the lead agency. The lead agency is typically one of the local councils or a county council within the regional project area, who agrees to take on administrative responsibilities for the project. Funding for program administration is inconsistent and unnecessarily complicated.

The funding for lead agency administration and project officer duties varies across the regions and is often inefficient with money transferring back and forth between entities. There is no standard requirement for funding a regional project officer, with some being full time, some part time, and one region not having one.

Table 10 indicates the amount of WAP funding provided to each region and the total co-contributions reported by LCAs for 2010-2013. Based on the information reported, LCAs are contributing on average 66 per cent of the funding for weed management activities that they carry out, including management of weeds on LCA land. It is important to consider that the NRC was unable to perform any quality assurance on these values, and **there is a considerable amount of uncertainty in these values.** For example, most project officers indicated that the co-contribution values to their knowledge only include actual dollars provided by local government. However, most also indicated that this has not been verified with LCAs.

Information provided to date does not distinguish between dollars spent on councils' own land management versus other activities. project officers consistently indicated the co-contribution amounts include **all** activities undertaken by the LCAs. Some project officers estimated that approximately one third of their co-contribution dollars are spent on weed control on LCA land.

Table 10: WAP funding and regional co-contributions 2010-11 to 2012-13[174]

	Totals (2010-11 to 2012-13)		% LCA contribution
	WAP	**Regional LCA contribution**	
Far North Coast	$2,707,053	$4,110,306	60%
Lachlan	$896,174	$1,485,001	62%
Lower Hunter /Central Coast	$1,278,706	$2,423,910	65%
Macquarie	$3,300,887	$6,044,474	65%
Mid North Coast	$1,297,739	$3,864,186	75%
Monaro	$809,615	$2,461,853	75%
Northern Inland	$3,134,037	$4,793,439	60%
Riverina	$3,783,596	$7,842,964	67%
Southern Councils	$1,342,173	$2,484,976	65%
Southern Tablelands	$1,811,024	$2,446,995	57%
Sydney	$2,215,514	$2,420,711	52%
Upper Hunter	$600,290	$850,342	59%
Upper Macquarie	$644,729	$4,242,326	87%
Total	**$23,821,537**	**$45,471,483**	**66%**

* Sydney actually reported $10,809,239 of LCA contribution for 2010. However, the following year it was reported that this reflected all funds spent on weed management for the region, from a wide range of funding bodies. Reporting for 2011 was adjusted to only reflect LCA contribution. For consistency with other regions, the NRC has estimated that Sydney expenditure for 2010-11 was approximately the same as for 2011-12.

Table 11 indicates proposed DPI funding and co-contributions for the WAP regional projects against the four goals in the Invasive Species Plan. These values are based on the applications which span a five-year time frame and are not actual dollars spent as the project is currently in its fourth year. DPI intended an increased focus on monitoring and evaluation in later years.

Table 11: Proposed funding for Goals 1-4 across NSW for the period 2010-2015 [175]

Goals: NSW Invasive Species Plan	Proposed WAP Funding	Proposed Co-contribution	Total project
1 Prevent the establishment of new invasive species (prevent)	$961,292	$617,132	$1,578,424
2 Eliminate or prevent the spread of new invasive species (eradicate)	$17,527,308	$10,136,783	$27,664,091
3 Reduce the impacts of widespread invasive species (manage)	$5,307,553	$25,190,105	$30,497,658
4 Ensure NSW has the ability and commitment to manage invasive species (capacity building)	$16,963,646	$26,519,526	$43,483,172
TOTALS	$40,759,799	$62, 463,546	$103,223,345

[174] Data provided by DPI – personal communication, 1 November 2013.
[175] *ibid*.

There is little assurance provided for whether funds are actually spent on what they were allocated for. For example, the annual WAP reports only include a total value for amount of funds received and the amount of co-contributions. Given the lack of surety of these values, the NRC has assessed them only to indicate what the intended funding allocation is under the WAP.

The proposed values show that over 70 per cent of total funds are intended to be spent on Goals 3 and 4 i.e., management of widespread weeds and capacity building, and just under 30 per cent of total funds is intended for Goals 1 and 2 i.e., prevention and eradication of incursions.

On a goal-by-goal basis:

- LCA co-contributions spent on control of wide-spread weeds (Goal 3), including control on their own lands, represent 83 per cent of the total funds allocated to Goal 3.
- LCAs co-contributions spent on surveillance and enforcement for new and emerging weeds (Goals 1 and 2), represent 30 per cent of the total funds allocated to Goals 1 and 2.
- LCAs co-contributions spent on ensuring NSW has the ability and commitment to manage invasive species (Goal 4), represents 61 per cent of the funding for Goal 4. Goal 4 predominantly includes education, training, community outreach and capacity building, which are important for managing both incursions and widespread weeds.

Based on these proposed values, LCA proposed co-contributions are allocated predominantly to managing widespread weeds and capacity building/education (Figure 18); and WAP funding is allocated primarily to eradicating incursions and capacity building/education (Figure 19).

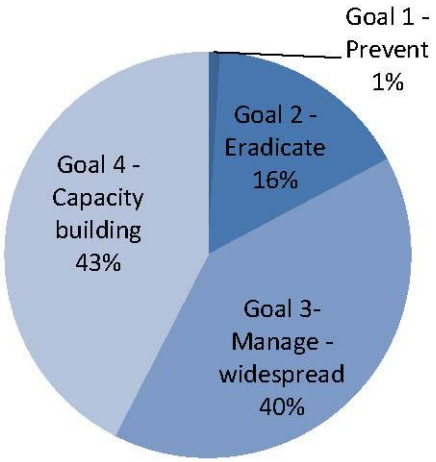


Figure 18: Allocation of LCA proposed co-contributions

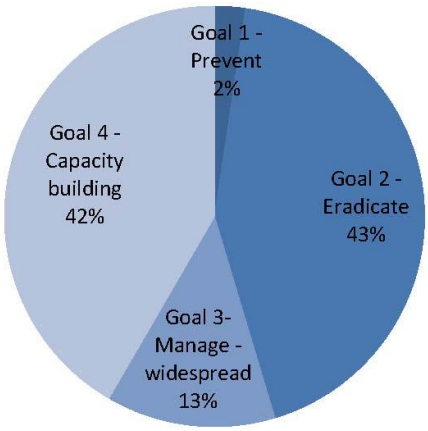


Figure 19: Allocation of WAP funding

DPI also provides WAP funding for state-wide projects and 'innovation projects', through a competitive bidding process. State-wide projects range from addressing a specific weed, to broad issues like Crown Land management and aquatic weeds. The Noxious Weed Advisory Committee determines funding for state-wide projects and DPI is the lead agency for several of them. Table 12 shows the total allocations for state-wide and innovation projects for the first three years of the WAP.

Table 12: WAP state-wide and innovation project funds[176]

	2010-2011	2011-2012	2012-2013	Total
State-wide projects	$924,049	$1,447,685	$1,395,408	$5,296,040
Innovation projects			$1,090,005	

Weed Action Program planning

The WAP is intended to support the Invasive Species Plan. Respondents indicated that the Invasive Species Plan provided a clear step forward in planning at the state level, providing concise guidance for state and regional level planning.

Each WAP project is required to prepare five key management plans: a new incursions plan, a rapid response plan, a high-risk pathways plan, an inspection plan and a communications plan. These plans should guide actions and spending. A review of these plans indicates that the quality and content varies greatly across the state. For example:

- The specificity and apparent purpose of the plans varies, with some briefly expressing high level regional strategy and others providing detailed LCA level plans. Some regions combined the plans into one comprehensive strategy and some regions have five separate plans.
- The audience of the plans differs with some being targeted at all stakeholders and others specifically for WAP participants.
- High-risk pathways are not consistently defined, and the frequency of inspections required for both high-risk and general priority sites varies considerably and is not specified for all regions.
- Weeds are not classified consistently. Some plans refer to the Noxious Weed listing categories (Class 1-5) whereas others use a four category system (A-D) and rapid response plans vary in which classes they focus on.

project officers indicated that these plans would benefit from more state-level guidance. DPI provided training for project officers at the start of the project. Some project officers also noted that adherence to regional plans varied across LCAs. NRC did not find evidence of a systematic quality assurance or assessment process to ensure the quality and consistency of the plans across the state.

Weed Action Program results

Interviews indicate that the majority of participants feel that the WAP has created significant improvements in weed management by LCAs. Specific improvements cited by many of those interviewed included:

[176] Funding allocation reports obtained from extranet.dpi.nsw.gov.au/weeds/grants.

- The WAP emphasis on surveillance and eradicating new and emerging weeds has led to an improved focus on this area and greater regional understanding of the importance of these aspects of weed management.
- Having specified outputs/targets that must be reported has clarified for LCAs what the required actions are and improved surveillance.
- Many LCAs that were previously poor performers have reportedly improved their performance partially due to clearer requirements and partially due to coordination by the project officers and peer pressure from WAP project partners.
- There has been some improvement in strategic planning and coordination between LCAs, although this varies by region.
- Some councils are working more effectively and cooperatively. For example, some regions are implementing consistent weed tracking systems to inform regional planning. However, in other regions LCAs are not sharing data with each other.
- The program has improved DPI administrative efficiency as they used to process applications from more than 100 LCAs and now they only process 13 regional applications. However, the administration work is now largely borne at the regional level.

The NRC found that having a dedicated project officer played a critical role in coordinating programs across regional LCAs and ensuring some consistency and adherence to commitments made under the WAP program. Many respondents attributed much of the success of the WAP to the strong performance and contributions of the regional project officers.

The initial years of the WAP were devoted to rolling out an improved framework for the planning and funding of weed priorities at both a state and regional level, while also building the capacity of participants to undertake the work required and to improve their ability to meet monitoring, evaluation and reporting standards.

While good progress has been made by implementing the WAP, the NRC's evaluation indicates there are several areas where there are still opportunities for improvement:

- **Greater outcomes focus** - It is difficult to determine whether the WAP has improved outcomes. There are measures that each LCA must report, such as number of priority high-risk sites inspected. These are outputs, rather than outcomes. DPI has acknowledged that improved outcomes reporting is needed and will be considered in the future.
- **Clarifying roles and responsibilities –** Respondents consistently expressed that roles and responsibilities at all levels of the WAP are not clear and are not consistent across the state. Regional and local level staff could not consistently articulate the responsibilities of the DPI staff in the WAP, and many stated that it would be helpful to have their roles more clearly defined.
- **Lack of accountability –** Stakeholder feedback indicates that there continues to be a wide range of performance by LCAs, with little or no consequences for those who are not meeting their obligations. The monitoring and reporting required by DPI does not allow for assessment of whether these responsibilities are being carried out.

  WAP has gaps in the coverage. Some local councils do not participate in the program and do not have weed officers, including some Sydney councils that have high-risk activities such as farmers markets. Certain regions of the state were consistently identified by neighbours and DPI staff as poor performers, and in some cases there has been a lack of coordination between WAP and CMA weed related programs. Yet to date, there has been little evidence of action being taken to address poor performance.

- **Quality and consistency of reporting –** Limited quality assurance is performed on the WAP reports. Little guidance was given regarding what definitions or standards should be used for reporting on outputs and there is likely to be significant variance from region to region. The quality and consistency of reports depends greatly on the level of engagement of the project officers and lead agencies.

6.4 Catchment Action NSW funding

NSW Government provided Catchment Action NSW funding to CMAs for implementation of Catchment Action Plans (CAPs). CMAs have become part of LLS under new arrangements. CMAs typically focused on integrated land management, with the aim of achieving multiple outcomes. Integrated land management is particularly important for weed management, where failure to replace a weed with something more desirable can lead to re-infestation. A high percentage of on-ground projects have a weed management component, but the amount of money allocated specifically to weed management is difficult to ascertain, as this was not the sole focus of CMAs.

CMAs also focused on leveraging additional investment from other parties. A significant portion of their funds were acquired from Australian Government programs including Caring for our Country and the Biodiversity Fund, which are discussed further in the following sections.

In order to assess this funding stream, the NRC interviewed representatives from ten of the 11 former CMAs, and received a submission from the eleventh. In addition, the NRC reviewed publically available reports including the CAPs and CMA annual reports, but quantitative data regarding project spending was not taken from these reports as the funding sources could not be verified. The NRC requested data directly from CMAs regarding funding that was provided specifically for weed management projects. Many of the CMAs stated that the figures provided were indicative only.

CMAs estimated that approximately $2.7 million of Catchment Action NSW funding was allocated by nine of the eleven CMAs to projects predominantly focused on weeds over a three year period from 2009-2010 to 2011-2012. Two of the CMAs were unable to provide estimates in the time provided. CMAs emphasised that this is an underestimate of what was actually spent on weeds as some portion of the approximately $78 million Catchment Action NSW funding provided to CMAs over the past three years has also been dedicated to weed management. Co-contributions from project partners, financial or in-kind, vary significantly between CMAs and projects and are not included. However, most CMA funds are granted with a partner co-contribution required. Often this was provided through in-kind donation via volunteer labour.

Allocation of Catchment Action NSW funds to the CMAs is based on an independent six-stage assessment process[177] that considers priorities, return on investment, and likely effectiveness of programs. Effectiveness was assessed through NRC's audits of the CAP implementation.

Weed management activities supported by CMAs varied, from on-ground control works such as spraying and hand-pulling, to extension activities including workshops, 'weed safaris' and training, to monitoring activities. CMAs often collaborated with groups, such as Landcare, to strengthen a bid for funding of weed control projects. CMAs undertake and fund weed management work on both private and public land, where it is necessary to work across tenure to

[177] Natural Resources Commission (2010), *Review of Catchment Action NSW funding allocations to Catchment Management Authorities*, available at: nrc.nsw.gov.au/Workwedo/Fundingallocation/CatchmentActionNSWFundingAllocationToCatchmentManagementAuthorities.aspx

achieve results. Several CMAs were unable to quantify the split of funding across tenure; however, seven of the CMAs indicated that the majority of work is taking place on private land, typically 70 per cent of works or more.

CMA's coordination with LCAs, RWACs, and other CMAs varied. For example, one CMA has coordinated and funded a weed tracking program for all regional councils in its area. Another contracted sprayers directly to do weed control works, rather than work through local councils, indicating it is too difficult to coordinate with all the LCAs. Several CMA representatives noted that coordination between CMA regions could be improved. For instance, one respondent provided an example where two CMAs were planning large projects to handle a new incursion on a border region, but had not worked together on their applications or plans.

CMA strategic planning

CMAs typically prioritise their actions based on their CAPs. The priority placed on weed management varies among the CAPs. Most CMAs have a specific weed, invasive species or 'pest' plan informed by regional input. The degree of alignment between these plans and other regional plans varies by region.

The majority of CMAs indicated that despite strategic plans, actual funding of weed management projects has historically been skewed by investor preferences. In some cases the CMAs can identify common goals with funding partners, but overwhelmingly, they felt investor preferences had hampered their ability to make decisions based on local issues. Some noted that the funding requirements prohibit them from tackling weeds that are the landholders' responsibility (under the *Noxious Weeds Act 1993*), which fails to recognise that widespread weeds can rapidly progress to a point where a regional response is needed, or the significant impact they can have on agricultural productivity and environmental systems. Another restriction noted was that annual funding models are too short term to address weed problems and require them to commit their funds early, reducing flexibility. As a result they are particularly limited in their ability to tackle new incursions.

CMA monitoring and outcomes

CMAs all report certain standard outputs to DPI. Standard outputs related to weeds include total hectares treated and the per cent that represents initial treatment. Reports for 2011-12 indicate that almost 2.5 million hectares were treated with initial treatment of around 580,000 hectares. However, this is for all CMA funding. The NRC was unable to verify hectares treated solely from Catchment Action NSW funding.

Similar to the WAP, this reporting is related to outputs rather than outcomes. While some CMAs are implementing additional outcome measures, such as the distribution tracking discussed below, there is no consistent measurement of outcomes related to CMA weed management. This makes it difficult to assess the overall effectiveness of CMA weed management projects.

CMAs varied in their capacity to use spatial information systems to track weed infestations. Several are using the Land Management Database to map where the CMA's funded projects are carried out, but indicated that currently it provides limited information regarding weed location and distribution. The Border Rivers-Gwydir CMA uses a weed mapping system called Tr@cer Weeds, in conjunction with local councils. The system collects point data on weed infestations, locations and densities as part of each local council's property inspection activities. The information is then uploaded into the CMA Geographical Information System. However, only Weeds of National Significance are included. For these reasons current spatial mapping has

limited use in driving effective and efficient investment decisions, including where to direct follow-up works. Local council representatives in some areas are using weed tracking programs, but indicated they are only sharing this information with CMAs on a limited basis as requested by the CMA.

CMA's typically require project partners to agree to ongoing maintenance requirements, generally over 10 years. Many of the CMAs require annual reports with photo points, weed inspection reports, and any required follow-up actions. Most CMAs are unable to do on-ground inspections themselves, and where they do they may only target 5-10 per cent of projects per year. Some CMAs stated that even with such reporting requirements in place, weed projects are hard to keep on top of with little if any authority to enforce ongoing responsibilities.

6.5 Australian Government funding

The Australian Government provides funding for weed management through two key streams, Caring for our Country and the Biodiversity Fund.

6.5.1 Caring for our Country

The Caring for our Country program provides funding for a range of natural resource management issues. It includes both base funding, provided to CMAs (now LLS) in NSW, and grants provided through a competitive bidding process.

Over the past several years there has been a focus on WoNS in the Caring for our Country competitive bid process. This funding was seen as very effective in areas where the relevant Weed of National Significance was a high regional priority. However, in several regions, respondents indicated that the Australian Government funding was skewing their actions away from the highest priorities identified through strategic planning. For example, in the Monaro area several million dollars were spent on management of willows (*Salix sp.*) a WoNS, whereas stakeholders indicated that African lovegrass was a higher priority.

Caring for our Country projects typically focus on integrated land management, making it difficult to determine the total amount spent on weed management. The NRC reviewed the project descriptions of all projects funded through the competitive bidding stream from 2009-2011 and attempted to identify those primarily focused on weed management. This review showed that CMAs received around $7.8 million to undertake projects specifically related to weed management. A further $5.3 million was awarded to state agencies (former Department of Environment Climate Change & Water and OEH), local government (councils), a range of Care groups (e.g. Landcare, Rivercare), and other community conservation and volunteer groups specifically for weed management projects.

These figures do **not** include all projects that included weed management, only those specifically targeted at weeds, or where weed management was the primary focus; as such, this is a low estimate of what is spent on weed management. In total approximately $178 million was allocated for Caring for our Country competitive bid projects nationwide from 2009-2011. A large portion of these projects included some weed management aspect.

The competitive bid funding is in addition to the $141 million of base level funding awarded to NSW CMAs by the Australian Government from 2009-2011, some of which was directed to weed management projects (or those which incorporated it), in line with their CAPs. For example, from 2009-13, Western CMA funded approximately $510,000 of WoNS projects (Hudson Pear (*Cylindropuntia rosea*), Mesquite (*Prosopis sp.*) and Parkinsonia (*Parkinsonia aculeata*)). This was sourced from base level Caring for our Country funding and is therefore not included in the $7.8 million estimate above.

Caring for our Country outcomes

The NRC reviewed publically available information regarding outcomes and also requested example project reports from the Australian Government for Caring for our Country projects. Project outcomes were focused on the number of hectares treated. Therefore, similar to other weed programs, reports typically do not provide significant indication of weed management outcomes.

Some of the Caring for our Country funds were directed to WoNS, for which the Australian Government also funded national coordinators for specific weeds; funding for coordinators ceased in 2013. National and state-wide strategic plans are used to guide activities related to WoNS. In addition, coordinators developed business plans for their specific weed. A number of specific species have been actively mapped through this program. Standardised surveillance protocols and monitoring and mapping prior to and following control have allowed the coordinators to determine trends in distribution and density. This information can then be fed into subsequent planning for weed management in an adaptive management approach.

Bitou bush mapping is perhaps the best example of the demonstration of effectiveness of control efforts. Although the distribution of this species has increased between 2001 and 2008, spatial analysis has been able to show a significant reduction in the density of the weed, particularly the higher density category (greater than 40 per cent cover). This demonstrates reduced impacts. As a result of control efforts, the containment lines for the core infestation have contracted. This type of outcomes tracking represents good practice in monitoring of weed management programs.

6.5.2 The Biodiversity Fund

The Biodiversity Fund is a program under the Australian Government's Land Sector Package of the Clean Energy Future plan. It is designed to help land managers establish, manage and improve the condition of native vegetation on their land as well as reduce the effects of climate change by improving landscape resilience, increasing stores of carbon and reducing greenhouse gases.[178] This fund is likely to be significantly reduced or eliminated.

It is difficult to discern annual expenditure on weed management from this funding stream given the focus on revegetation and restoration of land and the six year time frame. The NRC has reviewed successful projects and estimates that approximately $8.6 million was invested in projects in NSW that focused predominantly on weed management from 2010-2011 to 2013-2014.[179] As with other funding streams, this is a conservative estimate as some portion of most projects would have included a weed management aspect. Based on the review of project descriptions, the NRC estimates there was approximately $30 million worth of additional Biodiversity Fund

[178] Australian Government, Department of the Environment, available at: environment.gov.au/cleanenergyfuture/biodiversity-fund/index.html, (accessed 2 December 2013).

[179] Based on descriptions of successful projects from Biodiversity Fund Round One (2011-12) and Round Two (2013-14), available at: environment.gov.au/cleanenergyfuture/biodiversity-fund/index.html, (accessed 2 December 2013).

projects funded in NSW from 2010-2011 to 2013-2014 that likely had a significant weed management component.

6.6 Other funding

- **Environmental Trust – NSW Government**: From 2010-2011 to 2012-2013 the Environmental Trust provided $10.6 million for projects that had a significant weed management component. These included community and government grants for projects across public and private tenures, for specific research, eradication, containment and asset-protection weed projects. Many projects included weed management in restoration, rehabilitation and bush regeneration projects.[180]
- **The Public Reserves Management Fund:** This fund provides financial support for the development, maintenance and improvement of public reserves and is managed by the Crown Lands Division of NSW Trade & Investment. Funds are allocated each financial year to reserve managers through an application assessment process.

  Crown Lands Division provided $585,000 to fund over 166 weed management projects in 2011-2012.[181] Approximately $1.25 million has been recommended for over 140 projects focused on weed management in 2013-2014.[182]
- **Office of Environment and Heritage:**

  NPWS estimates the following expenditure on weeds over the past three years. This represents 54 per cent of the total amount spent on pest and weed management[183]:

Table 13: NPWS weed management spending estimates

Year	2010-2011	2011-2012	2012-2013
NPWS estimated spending on weed management	$17.2 million	$18.7 million	$18.2 million

Pest management is guided through Regional Pest Management Strategies, which include pest plants and animals. Feedback indicates that combining pest plants and animals into one management plan is effective and efficient for national parks, where workers may be trained across both issues.

A 2009-10 NPWS assessment of volunteer hours found that 43,972 volunteer hours were spent on weed management, representing approximately 42 per cent of all volunteer time on parkland. If a value of $30 per hour is applied for volunteer labour, this equates to over $1.3 million in volunteer labour annually.

OEH received external funding from 2010-2013 totalling approximately $11 million. $3.8 million was for projects fully directed at weeds and $7.2 million for other projects that had a weed component. More than half (53 per cent) of this funding was directly from the Australian Government and 22 per cent from CMAs. An additional $490,000 or 4 per cent

180 OEH, personal communication, 2 October 2013, – estimate is based on a review of project descriptions to determine those with a weed management focus.
181 NSW Parliament Legislative Council General Purpose Standing Committee No. 5 (2013). *Management of public land in New South Wales*, NSW Parliament Legislative Council, Sydney, NSW.
182 Crown Lands Division of NSW Trade & Investment, personal communication, 9 December 2013.
183 OEH, personal communication, 2 October 2013 and 6 December 2013.

was provided from the WAP either directly from DPI or from LCA organisations. These values should be captured in estimates for these funding bodies.

- **Other public land managers**

  Data was not available from other public land managers other than Forestry NSW who spent $1,018,984 on weed control in 2010-2011, over half of which was spent on treating blackberry.[184]

6.7 Community programs

Community and volunteer programs such as Landcare and Bushcare are a vital part of delivering on-ground weed management in NSW. Community programs deliver services in the areas of outreach, education, capacity building and weed control.

The experience in Towamba Valley illustrates this point. In their submission the Far South Coast Landcare Association describe the current culture of wide spread weed management as 'don't do anything until you are told to' and of 'walking away from serious infestations'. They argue that the current arrangements do not support widespread weed management and that local control authorities do not risk legal action.

The Towamba Valley Landcare Group commenced a project in 2008 that in just five years has engaged more than 60 per cent of landholders in weed control with general support from another 20 per cent.[185] The project has effectively stopped serrated tussock from seeding, an infestation that once covered 20 per cent of the valley. The group is now also controlling African lovegrass reducing both its spread and density.

The Towamba project adopts collective action principles, developing a culture of co-operation and reciprocation. Meetings and events are attended by 25-60 people and social cohesion is a focus, reducing the isolation of farmers who are often overcome by tackling weeds and other pest problems alone. The project is based on a 'set of rules' that target coordinated effort and long term monitoring programs. It accommodates the capacity of individuals by tailoring agreed management plans and providing incentives. This project has adopted a total farm management approach, engaging farmers in farm planning and increasing knowledge in natural resource management, pasture management and pest animal control.

184 NSW Parliament Legislative Council General Purpose Standing Committee No. 5 (2013). *Management of public land in New South Wales*, NSW Parliament Legislative Council, Sydney, NSW

185 Far South Coast Landcare Association submission to NRC Review of Weed Management in NSW(2013)

7 Draft recommendations

The NRC has developed a suite of recommendations intended to be delivered together to achieve more effective management of weeds in NSW. These recommendations should be delivered in collaboration with recommendations from other ongoing reviews including: development of the Biosecurity Act, reviews related to local government, Crown Land management, the NSW Invasive Species Plan and the Australian Weeds Strategy.

The NRC invites public comment on these recommendations and how they might be implemented.

7.1 Prevention, eradication and management of widespread weeds

Recommendation 1: The NSW Government should revise the current model for weed management based on:

a. a tenure-neutral approach to integrated weed management within the legislation, requiring all landholders to meet legislative and regionally agreed obligations

b. a clear division of responsibilities based on simplified weed categories:
   - **prevention and eradication** of incursions at the state scale
   - **management of widespread weeds** at the local and regional scale.

Weed management systems are designed to prevent or quickly eradicate weed incursions, and to manage and reduce the impact of already widespread invasive species. Both eradication and widespread weed management are potentially long term programs, but they differ in that eradication programs cease when the target weed is successfully eradicated.[186] On the other hand, widespread weeds require ongoing management obligations with no definitive time period. This is in part why early eradication is far more cost effective than trying to manage a widespread weed using containment or asset protection strategies.

It is beneficial to consider weed management as made up of two core strategies: prevention and eradication of incursions, and containment and asset management of widespread weed infestations, with a clear decision point for transitioning from one scenario to the other when eradication is deemed unfeasible.[187] Both strategies need to be managed effectively and concurrently. However, they require some different regulatory and management approaches to be effective.

Good practice for effective weed management incorporates specific, enforceable requirements as well as allowing for flexibility and adaptive management. Flexible approaches and a range of tools are particularly necessary for addressing widespread weeds. Widespread weeds present a

[186] Panetta, F.D., Cacho, O., Hester, S., Sims-Chilton, N., and Brooks, S. (2011), "Estimating and influencing the duration of weed eradication programmes", *Journal of Applied Ecology* 48(4): pp. 980-8.

[187] Sydes, T. (2012), *Using a local management zoning framework to foster a management continuum. Is the 'big four' a defeatist mindset and are their alternatives at a local and regional level*. Proceedings of the Eighteenth Australasian Weed Conference, Melbourne, available at: caws.org.au/awc_contents.php?yr=2012.

'collective action problem'[188] as seeds are easily dispersed across the landscape and individual land managers have little incentive to undertake weed control action if their neighbours are not also acting.[189]

Collective action problems present institutional challenges, requiring a greater focus on the social aspects of landscape management. Institutional arrangements for widespread weed management should meet the design principles for effective collective action programs, which include[190]:

- clear boundary rules defining who is in and out of the cooperative relationship
- local rules clearly defining expectations and obligations
- the capacity of the participants to collectively change the rules and tailor to local conditions
- effective monitoring of all participants
- graduated sanctions that depend on the context and seriousness of the offence.

NSW should provide for different arrangements to tackle eradicable incursions and widespread infestations. Government should be held accountable for preventing, identifying and responding to incursions and managing eradication. Governments are generally better placed for managing incursions since management relies on consistent surveillance, response planning, co-ordination, diagnostics, control, funding and legislative authority.[191] Regional and local stakeholders should be responsible for long-term management of widespread weeds. Priorities and required actions should be developed with input from a range of stakeholders to ensure their varying objectives and resources are considered.

In order to provide greater flexibility and support the two functions described above, the new legislation should provide for two types of enforceable management plans:

- species specific eradication plans
- regional weed management plans to address management of widespread weeds.

Details of these plans are explained in the following sections. The plans would specify obligations for landholders and be enforced by weed officers.

Tenure-neutral approach

A key finding of this review is that the different legislated responsibilities for public and private land managers has led to fragmented weed management and created tension between landholders. In response to the legislative council inquiry into public land management, the NSW Government supported in principle a "tenure blind" approach to the management of key landscape threats, such as bushfire, animal pests and weeds that do not recognise property boundaries.[192]

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188 Graham, S. (2013) "Three cooperative pathways to solving a collective weed management problem". *Australasian Journal of Environmental Management*. Vol. 20, No. 2, 116129,

189 Sindel, B., Berney, P., Coleman, M., Marshall, G. and Reeve, I. (2013), " *Improving regional adoption of weed control: A case study in the NSW Northern and Southern Tablelands"*, RIRDC Publication No. 13/016Project No. PRJ-007151

190 Ostrom, E.(2000) "Collective Action and the Evolution of Social Norms" *The Journal of Economic Perspectives* Vol. 14 No 3 pp. 137-158

191 Identification of risks and management of invasive alien species using the IPPC framework Proceedings of a workshop in Braunschweig, Germany 22-26 September 2003, available at: fao.org/docrep/008/y5968e/y5968e00.htm

192 NSW Parliament Legislative Council General Purpose Standing Committee No. 5 (2013). *Management of public land in New South Wales*, NSW Parliament Legislative Council, Sydney, NSW.

The current requirements for public landholders were found to create problems in preventing and managing incursions and for building cooperative responses to widespread weeds. In order to support the proposed institutional model new legislation should take a tenure-neutral approach, to be facilitated through formalised regional weed committees discussed further in Section 7.4. Reasonable requirements should be established recognising varied management objectives of different landholders, with all landholders then held accountable for agreed obligations.

7.2 Strengthening response to new incursions

Recommendation 2: The NSW Government be accountable for the management of weed incursions including:

a. establishing a reserve fund for responding to new high-risk new incursions (similar to the pest insect destruction fund)

b. preparing enforceable weed eradication plans consistent with response plans for other biosecurity responses, with funding arrangements to be negotiated between DPI and LLSs.

The early detection and effective response to incursions can be the difference between successful eradication and ongoing management requiring a potentially large and ongoing financial commitment by landholders.[193] Effective responses require preparedness, including clear roles and responsibilities and timely access to adequate resources. Response to weed incursions should be consistent with the rigour of responses to other biosecurity concerns.

Identification of a weed incursion should trigger immediate responses including implementation of rapid response plans. During the response period funds should be allocated for immediate eradication efforts and the general landholder obligations to cooperate with eradication efforts should take effect.

The biosecurity legislation should provide for the establishment of a NSW response fund for high-risk new incursions, similar to the pest insect destruction fund established in 1934 to deal primarily with locust outbreaks. This would be a reserve fund separate, and in addition to, current funding arrangements. As the location of weed incursions cannot be predicted and the benefits of eradication extend to the entire community the fund should have a broad base. A flat rate contribution by all LLS rate payers is recommended to establish the reserve fund. As with the pest insect destruction fund, the state should provide additional funds in an emergency if the fund is depleted. Consistent with cost recovery principles[194], the response fund should be established such that costs can be recovered where the risk creators or beneficiaries from an incursion can be clearly identified. These funds should also be used to leverage further funds from the Australian Government under existing intergovernmental agreements. This levy should only be collected once governments have also agreed to contribute to the fund.

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193 Rejmanek, M., and Pitcairn, M.J. (2004) "*When eradication of exotic pest plants a realistic goal?*" in Veich C.R. & Cout M.N. (eds) Turning the tide: the eradication of invasive species , IUCN IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland and Cambridge UK. Viii + 414pp.

194 Independent Pricing and Regulatory Tribunal of New South Wales (2013), *Draft Report - Review of funding framework for Local Land Services NSW*, available at: ipart.nsw.gov.au/Home/Industries/Other/Reviews/Land_Services/Review_of_a_funding_framework_for_Local_Land_Services_NSW/10_Sep_2013_-_Draft_Report/Draft_Report_-_Review_of_funding_framework_for_Local_Land_Services_NSW_-_September_2013 (accessed 2 December 2013)

This fund should be used only for on-ground works to respond to high-risk new incursions. The Ministerial Weed Advisory Committee (described in Section 7.3) should determine when an incursion is high-risk and eligible for response funding, and how long funding should be provided. Specific rules and requirements for the release of funds should be established.

The initial response period must be sufficient to allow the Ministerial Weed Advisory Committee to monitor progress, and review risks and timeframes. If the incursion is not fully eradicated during the initial response period, but it is still deemed eradicable over the longer term, an eradication plan should be implemented. The weed would also be declared as a category 2 weed (see Section 7.3) in relevant LLS regions upon release of the plan. The Ministerial Weed Advisory Committee should establish a maximum time limit for developing an eradication plan, to ensure that a long-term eradication program does not unduly tax the response fund.

Eradication plans should be developed by DPI in consultation with relevant LLS and LCAs as they will have responsibilities for carrying out the eradication in cooperation with landholders. Plans should identify management zones that may be of any scale, for instance, the entire state, a local government area or a number of properties. Eradication plans should be endorsed by the Ministerial Weed Advisory Committee, and should clearly specify:

- the purpose of the plan
- the areas that it applies to
- an estimated activity period
- the powers that it authorises
- roles and responsibilities
- management goals
- performance metrics, and monitoring programs.

Weed eradication plans should also specify the resources that will be required to implement the plan. Resource estimates should be conservative and secured for sufficient time to allow for the resolution of unanticipated issues and support post eradication activities. Funding for delivery of eradication plans beyond the initial response period should be negotiated between DPI, relevant LLSs and LCAs and other relevant stakeholders including industry, based upon an assessment of the scale of the incursion, the values that are likely to be impacted and identification of any risk creators.

7.3 Simplified weed declarations to support management objectives

Recommendation 3: The NSW Government should simplify and improve the transparency around weed declarations by:

a. reducing the number of weed categories to three: weeds prohibited from entering the state, weeds to be eradicated, and weeds to be managed as widespread weeds on a regional basis

b. developing a skills and stakeholder representation based Ministerial Weed Advisory Committee which will be responsible for transparent evaluation of weed declarations, based on assessment of potential long-term risks and impacts to the economy, environment and community.

c. implementing a 'permitted list' for sale of plants within NSW, starting with aquatic plants and transitioning to all species within five years.

Weed categories

Stakeholders find the five control classes of weeds under the *Noxious Weed Act 1993* confusing and the control requirements ambiguous as they do not clearly specify the management objective sought. This is particularly true for Class 4 weeds, for which the control requirements are vague, and some argue, unenforceable.

Australian jurisdictions that have recently updated their biosecurity legislation have used the opportunity to revise and rationalise the listing of organisms. A notable example is Western Australia[195], which provides a simple and robust categorisation that is easy to interpret. The NRC proposes to adopt a similar system where all weeds are placed in one of three categories:

- prohibited - Weeds will be assigned this category if they are not established in the state and control measures are to be taken in order to prevent them entering and establishing in the state.
- eradicate – Weeds will be assigned to this category if they are present in the state in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
- landscape management – Weeds will be assigned to this category if they are established but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent these weeds from increasing in population size or density or moving into an area currently free of these weeds.

As is currently the case, the declaration of a native species as a weed would require approval from the Minister for the Environment. All declared weeds will be banned from sale or distribution unless authorised by a permit.

[195] *Biosecurity and Agriculture Management Act 2007* (WA)

Containment is an important weed management strategy that must be tailored to the specifics of both the weed and the outcome sought.[196] A containment strategy can be employed to achieve either eradication or landscape management outcomes. Eradication plans should clearly identify the location and function of the containment areas that support eradication efforts which may span several LLS regions. Similarly, regional weed management plans should clearly identify the location and function of the containment areas.

This categorisation aligns well with the proposed model, allowing the state government to have primary responsibility for exclusion and eradication (categories 1 and 2) and the widespread weeds (category 3) to be managed regionally. Objectives and management requirements for category 3 weeds (landscape management), including specific landholder obligations, would be negotiated at the regional and local level. Adoption of these categories would clarify objectives and requirements for all weeds, and create a clear decision-point for shifting management objectives from eradication to landscape management.

Weeds should be declared at a scale that provides for strategic approaches to weed management.[197] In Victoria pest species are declared according to each catchment management authority region, demonstrating that declaration at this scale is feasible. While there will always be weeds that cross administrative boundaries, declaration at larger scales provides for more consistent declaration, and increased likelihood of covering an entire containment area.

Weed categorisation should apply at the LLS scale covering all LCAs in a region. The weed eradication and regional weed management plans should provide for the development of specific geographic management zones, and obligations that are appropriate to the management outcome sought. For instance, while a weed might be declared for eradication in an LLS region, the containment area where active control is required may be limited to a few LCAs, while other LCAs have surveillance obligations.

Conflict species

Weeds listed under any of the categories in the new system should be prohibited from sale or distribution to minimise risks. However, this should be subject to the permitting provisions described below that provide for handling of 'conflict species,' which may be declared but have some economic benefits to certain parties. This approach is in keeping with the NSW policy that biosecurity risks should be minimised without unduly impacting on trade.

The proposed Queensland *Biosecurity Bill 2013*[198] provides for the authorised use of declared species through a permit system. Permits may be issued for biological control, commercial use, scientific research or another type of use as prescribed under a regulation.

Similarly, the proposed NSW biosecurity legislation should include capacity for the NSW Government to issue permits for the use of declared species, including for commercial production. Applicants for declared species permits must be registered entities (See Section 7.6) and conditions on the permit should include details such as record keeping and reporting and the requirement to let an authorised officer enter and inspect.

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196 Grice, A.C., Clarkson, J.R., Friedel, M.H., Murphy, H.T., Fletcher, C.S., and Westcott, D.A (2012) C*ontainment: the state of play*, Proceedings of the Eighteenth Australasian Weeds Conference, pp.320-324

197 Downey, P.O., and Johnson, S.B. (2011), "*Strategic use of weed legislation to limit the spread of weeds in NSW*" Proceedings of the Seventeenth Australasian Weeds Conference Christchurch, New Zealand, available at: caws.org.au/awc_contents.php?yr=2010.

198 *Biosecurity Bill 2013* (Qld) ch 8.

Declaration process

Declaration of a species has major cost implications for private landholders and LCAs. It is imperative that the decision making process for determining the management regime for a weed is timely, transparent, evidence-based and objective. The decision to move from a plan to eradicate an incursion to treating a weed as widespread should also be a clear and distinct, evidence-based decision. Further, where eradication is not feasible because there are no known or only very expensive control options, additional research should be considered as an action, with a periodic re-assessment to determine if research results affect the assessment.

The *Noxious Weeds Act 1993* provides for the Minister to create advisory committees as determined necessary to provide advice on a range of issues. This provision should remain in new legislation. Currently the only committee established in this manner is the Noxious Weed Advisory Committee. The NRC recommends that this committee be replaced with a new small committee (Ministerial Weed Advisory Committee), with a balance of technical and policy-making skills, as well as stakeholder representation.

To ensure a balance of skills and stakeholders, while remaining of a reasonable size to function efficiently, the committee should consist of three skills-based representatives, three stakeholder representatives, four government agency representatives, and an independent chair, all appointed by the Minister. The skills-based representatives should have a range of skills and knowledge covering agriculture, social science, economics, and environmental science and familiarity with risk assessment, systems thinking and scenario planning. Three representatives should be chosen to represent industry and community stakeholders. Representatives from DPI, OEH, LLS, and Local Government should also be appointed. Selection of these appointees should ensure coverage of a range of policy development skills.

The advisory committee would have a number of responsibilities including:

- Advising the Minister in regards to whether a new incursion warrants release of incursion response funding.
- Deliberating on declaration proposals and risk assessment outcomes and making final recommendation to the Minister regarding declarations, including when a weed should no longer be declared a category 2 - eradicate, or where regional efforts have enabled a weed to be shifted from a category 3 to a category 2.
- Providing general policy advice when requested by the Minister.

Permitted list

The NRC has considered whether the adoption of a 'permitted list' (also known as a 'safe list' or 'white list') approach, as a complement to current prohibited list, would improve prevention efforts. This precautionary approach allows only plants that have been risk assessed and placed on a safe list to be moved into and sold within NSW.

There is strong support for this approach, for example, from the Invasive Species Council, by many environment NGOs, bush regeneration groups, regional weed advisory committees and local governments.[199]

[199] Invasive Species Council, Australian Association of Bush Regenerators, Greening Australia, National Parks Association of NSW and Nature Conservation Council of NSW (2013) *Review of Weed Management in NSW*. Submission to the Natural Resources Commission, December 2013.

The foundations for a nationally coordinated permitted aquatic weed list are already in place. As early as 1982 the National Committee on Management of Aquatic Weeds developed a list of undesirable species and recommended a national ban from sale.[200] In 2008, Land and Water Australia funded a project to identify and assess the weed risks of all known species in the aquatic plant trade. The project adapted and applied the New Zealand Aquatic Weed Risk Assessment Model so as to better reflect factors relevant to mainland Eastern Australia.[201] In 2008, the group recommended to the Australian Weeds Committee 25 species for national ban on sale and distribution, with a further 21 species recommended for further evaluation. However, this list has not been fully adopted by each of the states and the adoption of a nationally consistent approach is still under consideration.

Recognising the potentially large benefits from improved prevention of new incursions, NSW should migrate to use of a permitted list that would regulate sale of plants. NSW should also continue to advocate for improved national alignment of declarations.

As a first step a list of aquatic weeds permitted for sale should be adopted given that the majority of the pre-work required for adoption of a permitted list has already been completed, and the high-risk created by aquatic weeds.

In no more than five years, NSW should transition to a full state-wide permitted list regulating sale of species within NSW. The nursery industry should develop the initial list within 12 months, identifying all the plants it proposes for sale. The Ministerial Weed Advisory Committee should then review the list to confirm or remove species where risk is deemed too high. A public consultation period should be provided prior to finalising the list. Future additions to the list should be reviewed and recommended by the Ministerial Weed Advisory Committee.

7.4 Regional coordination and local delivery for widespread weeds

Recommendation 4: The NSW Government should support a co-ordinated regional and localised approach to managing widespread weeds by:

a. continuing local level service delivery by LCAs

b. developing eleven statutory regional weed committees comprising LCAs, public and private landholders and community members (similar to the Bushfire Management Committee model) as subcommittees to LLS, and aligned with LLS borders

c. tasking the regional weed committees with developing regional plans and priorities for widespread weeds and surveillance

d. ensuring all regional plans are based on best available local knowledge, research findings and currently available technology, and promote innovative approaches to behavioural change and adoption of integrated land management practices

e. encouraging state bodies and the Australian Government to align funding with regional priorities identified in these strategic plans.

[200] Petroeschevsky, A., and Champion, P., (2008), *Preventing further introduction and spread of aquatic weeds through the ornamental plant trade* Proceedings of the 16th Australian Weeds Conference, Cairns, Australia, available at: caws.org.au/awc_contents.php?yr=2008.

[201] Champion, P.D., Clayton, J.S., Petroeschevsky, A., and Newfield, M. (2010) "Using the New Zealand Aquatic weed Risk assessment Model to manage potential weeds in the aquarium/ pond plant trade," *Plant protection quarterly* Vol. 25(2).

Local service delivery

Local service delivery by LCAs is a significant strength of the NSW system, and should be maintained, consistent with the NSW commitment to localism. Under the proposed model LCAs would continue to provide delivery of weed management services including surveillance, initial enforcement, engagement, capacity building, and weed control on their own land. Implementation of these services at the local scale is important for building relationships with local stakeholders and fostering community ownership for weed management.[202] However, clear standards for performance and improved accountability are necessary to ensure consistent service delivery across the state.

The NRC recognises the potential economies of scale arising from formal groupings of LCAs through shared services arrangements. For instance, pooling resources could facilitate adoption of existing technology such as remote sensing and GIS systems currently too costly for some individual LCAs. It is also recognised that the independent local government review has recommended that regional 'joint organisations' are established based on the Council Controlled Organisation model similar to that in the *New Zealand Local Government Act 2002*.[203] LCAs may choose to transfer weed management responsibilities to a joint organisation where needed to meet service delivery standards.

Regional coordination

Strategic planning for weed management needs to take place on a landscape scale and work across tenures and organisational boundaries. LLS is best placed to take on responsibilities for regional coordination of weed management under new institutional arrangements. LLS was created to provide integrated land management services by building strong partnerships with landholders, industry, community groups and governments. The LLS incorporates:

- CMAs who have a demonstrated capacity for integrated landscape planning and building whole-of-government and community consensus
- LHPAs with experience in biosecurity and land management
- extension services with knowledge of production systems and capacity building.

Therefore, LLS is ideally placed to provide coordination of weed management that is integrated with broader land management and biosecurity efforts. LLS also have the capacity to raise levies, which they may choose to do for control of specific weeds in consultation with the community. This may be necessary to provide secure long-term funding resources for some widespread weeds, containment and eradication initiatives.

LLS should ensure that weed management is integrated into broader land management where feasible, and that innovative solutions are trialled. For example, the Southern Rivers CAP aims to manage causes of weed establishment and prevention of further incursions and recommends investment in drought preparedness, drought management, and grazing management training to reduce the threat of the natural shock of drought.[204]

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202 Office of the Auditor General Western Australian (2013), *Managing the Impact of Plant and Animal Pests: A State-wide Challenge*, Western Australian Auditor General's Report. Office of the Auditor GeNeral Western Australia, Perth. December 2013

203 NSW Independent Local Government Review Panel (2013), *Revitalising Local Government: Final Report of the NSW Independent Local Government Review Panel*. Division of Local Government, Sydney.

204 Southern Rivers Catchment Management Authority (2013), *Southern Rivers Catchment Action Plan 2013 – 2023*.

Further, LLSs should support public education and extension programs in partnership with LCAs. These responsibilities are consistent with the historical role of organisations now part of LLS and the mandate for the LLS.

Regional management plans and committees

A tenure-neutral landscape approach to widespread weed planning will require a well-organised regional committee with representation from a range of stakeholders including public and private landholders and communities. The Bushfire Management Committee model is widely supported as good practice.

During consultation representatives for public land managers noted the benefits of the Bushfire Management Committee model include: they are statutory, providing confidence in longevity; the composition is specified and includes a broad range of stakeholders; roles and responsibilities are clearly defined; and participants are made accountable for meeting obligations.

Regional weed committees, similar to the Bushfire Management Committees, should be established. The committees should be consistent with the LLS boundaries, and report to the LLS Boards. LLS should appoint the Chair of each committee. These committees should build on the relationships and progress already made through the various existing regional groups.

The primary role of these committees would be to negotiate and prepare regional weed plans for management of widespread weeds and surveillance. The regional plan would replace a range of currently existing plans, reducing confusion and facilitating improved co-ordination and collaboration. The plans would be endorsed by the LLS Board and should be enforceable. The LLS Board of Chairs should be responsible for ensuring cooperation where action is required across LLS boundaries. The committees would also make recommendations regarding the declaration of weeds for their region, providing consistency for regional LCAs.

Regional plans will be prepared in a consistent format following guidelines endorsed by DPI and LLS in order to ensure consistency. The plans will comprise:

- the current plans prepared regionally for the WAP, including – new incursions, high-risk pathways, rapid response, inspections and communications
- the detail of any relevant and endorsed eradication plan that has effect in the LLS region, including spatial management zones and clear articulation of the management objectives for those within the zones
- the detail of LLS programs for the management of widespread weeds, including clear management objectives and performance metrics
- the agreed management obligations for all types of land managers
- monitoring, evaluation and reporting requirements
- relevant state and regional guidelines and codes of practice - for example vehicle hygiene.

This regional planning approach is consistent with good practice for collective action as:

- committees will be made up of public and private landholders, LCAs and community representatives and be based on LLS boundaries, providing clear indication of who is a part of the arrangement, and supporting the principle of shared responsibility
- the regional weed management plans will clearly define management objectives, and landholder responsibilities for meeting those objectives

- the level, type and location of controls required to respond to widespread weeds will be negotiated by the regional weed committee, allowing participants to tailor their widespread weed responses to the objectives and constraints of the regional stakeholders
- agreements made under the regional management plans will be enforceable. The Local Control Authorities will enforce the requirements.
- disputes may be addressed through the regional weed committee.

LCAs should work together with the LLSs and local community groups to develop targeted public education programs to support the regional plans. This will help to ensure that land managers understand their obligations and raise community awareness about the seriousness of weed incursions. Over time, the partnership between LLSs and LCAs should also lead to efficiencies through integrated management of pest plants and animals.

State level support

In order to support the regional arrangements and local delivery, the state government should:

- provide strategic guidance on weed species with impacts at the state scale
- coordinate program delivery with other state departments
- coordinate eradication plans to ensure cooperation and consistency across boundaries
- develop state-wide service delivery standards for LCAs
- produce codes of practice on key operational matters including the rotation of herbicide type to avoid the development of herbicide resistance
- prepare and disseminate educational and capacity building material
- prioritise research needs.

Funding

Under the *Noxious Weed Act 1993*, LCAs have responsibility for surveillance and monitoring. However, a joint-funding arrangement has developed over time whereby LCAs and state government effectively share the cost of surveillance, monitoring and capacity building. The relative proportions within the cost sharing arrangements vary considerably across the state.

Under the proposed model the state government has overall responsibility for ensuring monitoring and surveillance for prevention and eradication of incursions. As such, it is appropriate that they contribute to supporting the surveillance network and capacity building. The joint funding arrangements for these services should be retained and formalised. LCAs should at least match funds received from DPI through WAP.

The specifics of joint funding arrangements should be determined at the LLS scale to allow consideration of regional variations in incursion risk. For example, there may be an argument for a greater state contribution to the surveillance of sites or pathways that pose incursion risks to the entire state such as ports and markets.

The regional surveillance plans developed by the regional weed committees should indicate the resources necessary to carry out the specified duties, and be used as a basis to negotiate shared costs with DPI. Under the recommended model, DPI should allocate WAP funding to the LLS regions using a risk-based and strategic funding allocation process, such as the NRC funding

allocation model previously used to allocate funds to CMAs.[205] The LLSs would then allocate the funds to LCAs in accordance with the regional plans. LCAs should be required to commit to specific co-contributions for fulfilling their duties not related to management of their own land and roadsides.

LLS regions may also choose to raise a weed specific levy on top of currently available funds in order to address particular concerns within their region. For example, a particular region might decide to employ an aggressive containment program for a specific weed, which they aim to move towards declaration for eradication. This might be funded by a weed specific levy.

Funding for weed management should be long-term to provide confidence to participants that projects will be maintained for the duration necessary to succeed. LCAs and LLSs should continue education and awareness efforts to raise the profile of weed issues so that community members understand the significant risks, support ongoing funding, and increase funding where necessary.

Establishment of the regional management plans should provide stakeholders with a more consolidated set of regional priorities, and provide a means to better leverage additional investment. Various land managers have different priorities and may still choose to fund alternative priorities. However, the regional strategic plan would allow stakeholders to identify where their priorities align with broader goals so that they can leverage their investments. In particular, the Australian Government should be encouraged to align their funding with agreed regional priorities. The tenure-neutral approach would also allow for improved coordination of funds across landscapes and boundaries.

Education and community programs

The good practice examples of educational programs described in the findings should be built upon to expand and improve education and capacity building programs. Education programs should be designed considering the following:

- using a range of communication tools to target different landholders, such as media releases, emails, field days, etc.
- ensuring education programs are coordinated, long-term and focus on a range of issues including clarifying the goals, objectives and responsibilities for weed management. It is essential that programs relay what the expectations are for people and not just 'raise awareness'.[206] Increased awareness does not necessarily lead to improved weed management.
- tailoring programs to the concerns of the audience, and highlighting the range of serious impacts from weeds. For instance, emphasising the health and economic impacts may be more effective in peri-urban areas than focusing on impacts to farmland.
- focusing on integrated land management and long-term solutions, not 'spray and walk away'.

Community programs play an essential role in weed management in NSW. LLS and LCAs should recognise the critical role of community-based programs, and provide greater opportunities for co-design of programs and community led initiatives.

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[205] Natural Resources Commission (2013) *Review of Catchment Action NSW 2013-14 funding allocations to Catchment Management Authorities*, Natural Resources Commission, Sydney, May.

[206] Sainty, G., McCorkelle, G., and Julien, M. (1998) "Control and spread of Alligator Weed *Alternanthera philoxeroides* (Mart.) Griseb., in Australia: lessons for other regions", *Wetlands Ecology and Management'*, 5: pp. 195–201.

7.5 Accountability and performance improvement

Recommendation 5: The NSW Government should improve performance and accountability by:

a. strengthening the enforcement provisions in any new legislation:
   - providing for more substantial penalties, based on the severity and type of the offence
   - assigning responsibility for enforcement action beyond the initial issuance of a weed control notice to Local Land Services, and simplifying the requirements for taking action

b. developing state-wide service-delivery standards for LCAs. DPI should audit LCAs against these standards, with LLS given the ability to assume the LCA's surveillance responsibilities if the LCA cannot meet their obligations. LCAs would not be relieved of responsibilities to manage their own land or roadsides.

c. assigning an independent state-level auditor to assess LLS and DPI's performance in weed management, and the extent to which funding has been allocated in line with strategic priorities

d. providing for consistent, state-wide weed mapping including:
   - adopting standard data protocols and record keeping requirements, which are mandatory for any body receiving government funding for weed management
   - developing and maintaining a state-wide data sharing system for tracking weed distribution and density, which has current data from all LCAs

e. ensuring that data is readily available to stakeholders and regional managers for use in adapting management plans and actions.

Proposed institutional and regulatory changes will not lead to any change without improved accountability at all levels. In fact, many complaints about the current institutional arrangements are not problems with the arrangements themselves, but instead a lack of accountability for meeting obligations under the arrangements.

Enforcement provisions

At the property scale, current enforcement mechanisms are insufficient to effectively create compliance. This is due to low penalties, the cost and time associated with elevating a case to court or undertaking controls, and sometimes unwillingness to enforce vague requirements. Several changes to the enforcement provisions are needed to improve their effectiveness including:

- providing for more substantial penalties, based on the severity and type of the offence. Penalties should be sufficient to encourage compliance.
- simplifying the requirements and shortening the timeframes that exist under current legislation for allowing government to either undertake control on private land or take a case to court.
- assigning responsibility for enforcement action beyond the initial issuance of a weed control notice to LLS. These responsibilities include potentially taking an issue to court, or undertaking weed control and seeking compensation from the landholder.

The requirements surrounding control orders are currently inhibiting timely response to sometimes urgent weed management issues. While taking into consideration requirements for due process, revisions to the legislation should seek to streamline the process so that serious violations can be more quickly addressed with enforcement actions such as undertaking control on private land where the landholder has refused to comply with Weed Control Orders, or taking a case to court.

The NRC recommends that enforcement be escalated to the regional level when landholders have refused to comply with an initial control order issued by the LCA. This would have several benefits over the current arrangements. LLS may have access to greater funds and resources and are therefore better placed to either undertake control and seek reimbursement from the landholder, or take the landholder to court. The LLS may also be more removed politically from local conditions and therefore in a better position to enforce weed management requirements without detrimental effects to LCA community engagement efforts.

Service delivery standards

A set of service delivery standards should be independently developed to ensure high quality and consistent service delivery across NSW. DPI would then become responsible for auditing LCAs against the standards. The NRC further proposes that LCAs that repeatedly fail to meet the requirements of the standard would have their responsibilities, other than weed control on LCA land and roadsides, transferred to the relevant LLS. It is noted that the current legislation already allows the Minister to transfer responsibilities from an LCA if they are not meeting their obligations. Funding allocated by the LCA for their surveillance and monitoring would also be transferred to LLS.

State and regional accountability

The new arrangements should also require that LLS performance be assessed as they will become responsible for ensuring delivery of the regional management plans. An independent auditor should be assigned to ensure that DPI and LLS are meeting their weed management obligations including evidence-based strategic planning, assuring service delivery, efficient and effective funding allocation, and providing specified state-wide services.

Improved monitoring, evaluation and information management

Improvements to current record keeping, monitoring and reporting are also essential for improving accountability. The ability to track progress and adapt decision making to current conditions is essential for addressing weed incursions and demonstrating performance.

As soon as possible, the NSW Government must implement standard weed mapping protocols, which will become mandatory for any party receiving government funds for weed management. Biosecurity NSW should maintain a whole-of-government centralised data sharing system where weed tracking data is kept up to date. Several LCAs have already implemented tracking systems whereby weed officers input key information including weed location and density estimates on each site visit. Feedback indicates that it would not be difficult to develop standard data protocols to allow the range of tracking systems currently in use to report into one centralised system. In addition to facilitating better planning and adaptive management, this will increase accountability as it will allow tracking of when inspections have been completed and what actions were taken.

Adaptive management

Adaptive management is important in weed management where priorities and assumptions may change relatively quickly due to changing circumstances such as land use and climate variations, and where optimal control techniques may be unknown. It is also necessary to ensure that innovative approaches are trialled, so that better responses to weed infestations can be identified.

Adaptive management should[207]:

- support explicit learning, especially about the effectiveness of different actions rather than waiting to have complete knowledge about something before trying it
- reduce uncertainty over-time about the best ways to manage for our values in a coherent and accountable way
- implement the activities that are most likely to achieve desired objectives after assessing likely outcomes, averaged over all possible scenarios
- where appropriate, consider intentionally manipulating the system at hand to test response and accelerate learning.

LLS incorporates former CMA staff who have a history of implementing adaptive management programs, including testing new approaches and altering management practices based on results. CMA knowledge should be leveraged by the regional weed committees to ensure that adaptive management is incorporated into regional plans and actions.

[207] Derived from Duncan, D.H. and Wintle, B.A. (2008), "Towards Adaptive Management of Native Vegetation in Regional Landscapes", in Pettit C, Cartwright W, Bishop I, Lowell K, Pullar D, Duncan D, editors. Landscape Analysis and Visualisation – Spatial Models for Natural Resource Management and Planning. Springer–Verlag GmbH, Berlin, pp. 159-182.; Kofinas, G. (2009) "Adaptive Co-management in Social-Ecological Governance", in F. Stuart Chapin III, G.P. Kofinas and C. Folke (eds) *Principles of Ecosystem Stewardship – Resilience-Based Natural Resource Management in a Changing World*. Springer Science and Business Media, NY USA. pp 77-101; Keith, D.A., Martin, T.G., McDonald-Madden, E., and Walters, C. (2011) "Uncertainty and adaptive management for biodiversity conservation". *Biological Conservation* 144: 1175-1178.Hauser, C.E. and Possingham, H.P. (2008) "Experimental or precautionary? Adaptive management over a range of time horizons". *Journal of Applied Ecology* 24: pp. 72-81

7.6 More effective risk management

Recommendation 6: The NSW Government should improve risk management by:

a. creating a general biosecurity obligation that requires all stakeholders to take all reasonable and practical measures to minimise biosecurity risks

b. establishing a property weed status certification scheme, using the existing surveillance and monitoring programs, which would be disclosed on the sale of land and provided to parties who lease public land

c. requiring the registration of commercial entities whose activities generate weed risks, for example nurseries and fodder distributors, and making it an offence for un-registered entities to carry out these activities

d. encouraging greater self-management of weed risks by competent parties by providing for the establishment of industry contribution schemes and auditable compliance agreements

e. appointing LLS as the single authority to control declared aquatic weeds within a specified region.

The NRC also recommends that the NSW Government advocate for a review of the requirements for obtaining a minor use permit to improve access to herbicides for incursions.

General biosecurity obligation

The NRC supports the adoption of a general biosecurity obligation under the new biosecurity legislation, consistent with the requirements under the proposed Queensland *Biosecurity Bill 2013*.[208] This obligation applies to all types of landholders and requires them to take an active role in minimising biosecurity risks.

The adoption of a general biosecurity obligation is critical to the shared responsibility principle, which underpins the Biosecurity Strategy. A general biosecurity obligation requires that a person who knows, or ought reasonably to know, take all reasonable and practical measures to prevent or minimise a biosecurity risk such as the spread of weeds.

In Queensland, how a person discharges their general biosecurity obligation (e.g. washing down of farm machinery) is to be detailed in codes of practice and guidelines. Failing to discharge the general biosecurity obligation is an offence with heavy sanctions.[209] This is a model that has been suggested for the NSW biosecurity legislation and would be consistent with the NRC recommendations for weed management in this report. In particular it would provide a strong foundation for the tenure neutral approach and regional weed management plans.

[208] *Biosecurity Bill 2013* (Qld) s 23.
[209] Minimum $50,000 maximum $300,000 or three years imprisonment

Weed property status certificates

The effective operation of markets requires sufficient information for consumers to make informed decisions. There are a number of instances where a lack of knowledge regarding the weed status of a property contributes to poor weed management outcomes or imposes unexpected obligations on new owners, particularly in the sale and subdivision of property and the sale and distribution of fodder.

NSW surveillance and monitoring programs aim to ensure that the weed status of properties is periodically assessed, with the frequency of assessment varying according to the weed risk that the property or land use poses. The quality of this surveillance and reporting function varies considerably across the state. However, there is good state-wide coverage of qualified weed inspectors, which could support the establishment of a coordinated and consistent property weed status certification scheme. This could be incorporated within the suggested mandatory data tracking system, and would provide for consistent delivery across the state.

The surveillance and certification of property weed status for all properties greater than one hectare should be a key service delivery responsibility for LCAs. Future legislation should retain the provision for the accreditation by the state government of suitably qualified LCA officers. These officers could be authorised to issue weed status certificates for both private and public land.[210] The certificates would explain the weed status of a property in relation to key species for eradication and exclusion across the state, as well as priority weed species identified for particular LLS regions.

Properties would be assessed and certificates renewed every five years as a minimum with shorter frequencies for riskier properties or land uses possible. Land managers may request the LCA to update a property's weed status certificate more frequently on a cost recovery basis.

The certificates would follow a state-wide standard format and would be required:

- to obtain or retain registration as a nursery
- to obtain or retain registration to sell fodder (hay and silage)
- in planning information certificates[211]
- in applications for the subdivision of land greater than 1 hectare
- in leases for public land.

Requiring disclosure of the weed status on the sale of land will require an amendment to the provisions in the planning regulations.

The certification system would be phased in over a five year period, allowing time for landholders to address current weed issues. The development of one certificate to meet a number of requirements will reduce compliance and administration costs. The effectiveness and consistency of the weed status certificate process across the state would be monitored by the LLSs and subjected to periodic evaluation by the DPI.

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210 As per the *Local Government Act 1993,* officers issuing certificates would not incur personal liability if the process is undertaken in 'good faith'.

211 NSW *Planning Bill 2013* Division 11.3.

Commercial plant trade

Businesses in the commercial plant trade[212] should be required to be registered with the relevant local council. The business registration should require maintaining the appropriate level of the existing nursery industry accreditation[213] and property weed status certification. The sale of plant stock by unregistered businesses should be an offence.

Registration would require the identification of a responsible person, place of business and type of business activity, and registration of businesses would incur a small annual fee to cover the costs of maintaining the register and the cost of LCA inspections.

This system would not be capable of picking up small operators such as school fetes or small-scale market sellers. These cases will need closer surveillance by LCAs, and education at such events about weed risks.

Fodder industry

As for commercial plant traders, fodder sellers should be required to register with the relevant local council and the sale of fodder by unregistered producers should be an offence. Registration would require maintaining property weed status certification, and only properties free from all priority weeds would be eligible for registration. Again, registration would incur a small annual fee to cover the costs of maintaining the register and the cost of LCA inspections.

All fodder sales should be accompanied with a vendor declaration certificate that adheres to the industry standard[214], and the declarations should include a copy of the relevant property weed status certificate.

In some circumstances, a fodder producer would be able to apply to LLS for an exemption if their property contains a priority weed and they want to sell within the region where the weed is already prevalent and sale would not risk spreading the weed further.

Industry funding schemes and compliance agreements

Industry funding schemes have been implemented in Western Australia and use funding arrangements authorised under legislation to raise industry funds to tackle priority biosecurity issues. Since July 2010, three schemes have commenced to address biosecurity threats relevant to the grain, seeds and hay; sheep and goat; and cattle industries. In 2012-13 these schemes raised $4.5 million. An Industry Management Committee oversees each scheme and determines which threats require action, how best to deal with the threats, and what contributions will be needed from industry to tackle the problem. This arrangement allows for industries to self-manage biosecurity risks that may threaten their viability and sustainability.

Similar industry schemes could be effective in supporting industry to more effectively address specific weed concerns. For instance, if a particular weed impacts predominantly on graziers, graziers might wish to create an industry funding scheme to fund regional eradication of that weed. Additional regulation would be required to support such schemes including a requirement to register industry participants.

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212 It is expected that florists and others who sell cut flowers would be exempted.

213 Nursery Industry Accreditation Scheme (NIASA).

214 Australian Fodder Industry Association (AFIA) Fodder Care Domestic, available at: afia.org.au/index.php/fodder-care

Compliance agreements allow for greater self-regulation of weed risks by those parties that can demonstrate that they have the capacity for proper management and want the responsibility for self-assessment. For example, compliance agreements might be used by public authorities to demonstrate how they are meeting their weed management obligations through their operational procedures. Greater self-regulation by parties will allow limited regulatory resources to be applied more effectively. Parties to compliance agreements should be periodically audited to ensure compliance with the terms of the agreements.

Sale and subdivision of land and lease of state land

Lack of knowledge regarding the weed status of a property can contribute to poor weed management outcomes. Although 'buyer beware' is an accepted principle in contract law, the weed status of a property is difficult to assess by those unfamiliar with the landscape and land management requirements. These issues are primarily of concern in peri-urban and coastal regions where the transfer and sub-division of land and land transfer is more common. The NSW Government is currently considering the *Planning Bill 2013*. The bill, like current legislation provides for the provision of planning information certificates in relation to a particular parcel of land.[215]

The NRC recommends that the regulations supporting the *Planning Bill 2013* include the requirement for all planning information certificates to include:

- reference to any plan by the LLS or other public authority that details the weed management obligations for property in the region
- the most current property weed status certificate.

The regulation should also require that a current property weed status certificate accompanies all applications for the subdivision of land greater than one hectare. A subdivision certificate should not be issued unless specified weed management requirements are complied with.

Similarly, a current property weed status certificate should accompany all leases of state land, and the lease should clearly identify the lessee's responsibilities for weed management.

Aquatic weeds and spread via waterways

Aquatic weeds create unique risks and require specialised management. The complexity of aquatic weeds management was considered in the 2010 review of the *Noxious Weed Act 1993* issues paper. It was proposed that the Act be amended to allow the Minister to appoint a person or organisation, or a group of persons or organisations, as having the responsibility for aquatic noxious weed management in particular circumstances or for specified waters.

The establishment of LLS provides an appropriate regional body to take aquatic noxious weed management responsibility. Aquatic weed programs and resourcing strategies should be included in the regional weed management plans. This is not intended to include riparian weeds which remain the landholder's responsibility.

215 *Planning Bill 2013* (NSW) Division 11.3.

Responsibility for aquatic weed control does not mean that LLS has to undertake controls themselves, rather that they must ensure that appropriate controls are undertaken to meet regional plans and state-wide requirements. For example, the Hawkesbury River County Council has an extensive program for management of aquatic weeds and has the necessary equipment and skills for undertaking control. The LLS in this region could contract this county council to undertake aquatic weed management on a broader scale. Each LLS can determine the most cost effective implementation program for their region.

Minor use permits

NSW should advocate through APVMA for improvements to the minor use permitting process. Providing herbicides for treating incursions in a timely and cost effective manner will improve efforts to eradicate incursions.

7.7 Research and development

Recommendation 7: The NSW Government should actively support weeds research and development by:

a. rebuilding and maintaining NSW weeds research capacity
b. establishing a secure long-term funding strategy to deliver innovation and sustainable weed control outcomes together with the flexibility to respond to emerging priorities
c. prioritising areas for research and facilitating co-ordinated strategic research investment
d. supporting researchers to effectively communicate research findings to land managers
e. ensuring best available research and chemical choices are available to manage risk of herbicide resistance on roadsides.

With the best available data indicating that the cost and impact of weeds in NSW is growing, the need for research and development to deliver innovative solutions to these problems is also increasing. Over the last few years however, government funding for weeds research has decreased and become more uncertain with the reduction in Australian Government funding reducing leverage and subsequently inducing a decline in state investment.

Importantly, the decreasing funding is resulting in a critical decline in research capacity, both in numbers of weed scientists and research infrastructure. The implications of this are serious for Australian agriculture, particularly given the increase in herbicide resistant weeds, growing public concern about the use of pesticides and inadequate global investment in new chemistry.

Researchers are also concerned that governments' current approach to weeds research lacks strategic direction, continuity and coordination. Available funding is short term and competitive, discouraging collaboration and leading to inefficient projects with few tangible outcomes. Long term investment is fundamental weeds research, particularly to discovering effective alternative control strategies such as biological control agents. A clear strategic plan, identifying the most critical priorities will help to direct investment, and improve the ability to leverage additional dollars.

Another concern is that research findings are not effectively communicated to on-ground managers. For example, despite research demonstrating the need for management strategies to prevent herbicide resistance in weeds, some councils use the same chemical on the same

roadside year after year, even though it is increasing the risk of resistance. Resistant weeds will spread and cost adjoining landowners dearly. Reasons for this poor practice include cost to councils, human safety concerns, and a lack of awareness of resistance issues.

There must be management choices available and councils should have a rotation policy that they are audited against. APVMA and researchers need to provide chemical choices and research findings need to be effectively communicated to advance implementation of best available science.

The NRC recommends that the NSW Government take responsibility for improving the dissemination of latest research, ensuring that it is effectively communicated to farmers and weed management staff. Consideration should be given to making this one of the state-wide 'projects' currently funded by DPI under the WAP. Fulfilment of this recommendation may entail several aspects such as developing a 'virtual' research centre to organise and deliver latest information, and developing extension and educational programs.

7.8 Summary of roles and responsibilities

Figure 20 summarises roles and responsibilities under the proposed arrangements.

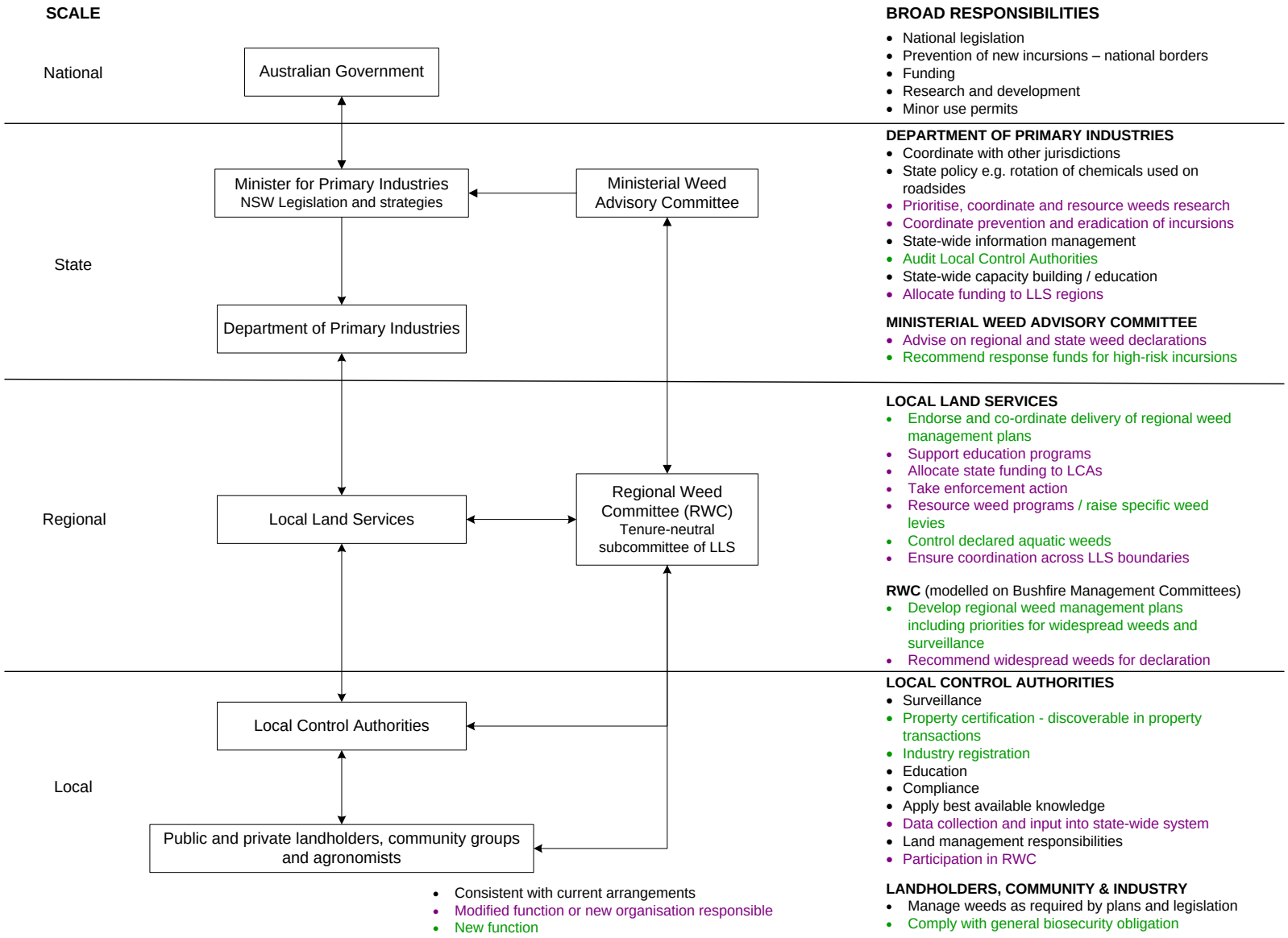

Figure 20: Proposed roles and responsibilities for weed management (copy of Figure 1)

Attachment 1: Terms of Reference

Terms of Reference for review of weed management in NSW

NSW 2021 sets out a range of actions to improve economic growth in regional NSW and strengthen local environment and communities. One of these actions is to reduce the impact of weeds on our production and natural assets, such as prime agricultural land and the reserve system. Under the recently released NSW Biosecurity Strategy, NSW intends to develop new biosecurity legislation that will further enhance the current risk-based approach to managing weeds (and disease and pests).

Weeds impact production and natural assets in varying ways. 'Noxious' weeds are declared under the *Noxious Weeds Act 1993*, and subject to a range of different controls. This Act obliges private and public landholders and managers to control declared noxious weeds on their land. Local Weed Control Authorities (i.e. Local Shires and Councils) have the primary responsibility to administer this Act. Other Acts such as the *National Parks and Wildlife Act 1974*, *Threatened Species Conservation Act 1995* and *Fisheries Management Act 1994* also provide for the management of terrestrial, freshwater and marine weeds and noxious vegetation. Native species acting in a weed-like manner (such as Invasive Native Scrub) are regulated under the *Native Vegetation Act 2003.*

Other mechanisms such as intergovernmental agreements and funding for regional bodies under Australian and NSW Government programs provide alternative drivers to promote the weed management outcomes sought by the NSW Government.

Evaluation of weed arrangements in NSW

The Minister for Primary Industries requests the Natural Resources Commission (the Commission) to evaluate the effectiveness and efficiency of the current weed management arrangements in NSW, with the view of informing the further development of the NSW Biosecurity Act and other relevant strategies under the NSW Biosecurity Strategy.

In developing its advice the Commission should:

- assess (based on existing data) the distribution and abundance of weeds across NSW and their impact on production and natural assets, having regard to historical trends and likely trajectory, current condition and risk creators and bearers
- evaluate current regulatory and institutional arrangements in meeting state agreed outcomes across both public and private tenures, including identifying characteristics of any constraints, barriers and best practice
- evaluate weed management activities funded by the Australian and NSW Government incentive and grant programs such as (but not limited to) *Caring for our Country* and *Catchment Action NSW*, *NSW Weeds Action Program*, including identifying characteristics of any constraints, barriers and best practice
- identify and assess viable alternative weed management arrangements, including risks and opportunities.

Any recommendations should include potential transitional arrangements for the future implementation of the NSW Biosecurity Act and NSW Biosecurity Strategy.

For the purpose of this work, 'weeds' is defined as both introduced and native species but is limited to terrestrial and freshwater aquatic species only.

The Commission should also have regard to the following in undertaking the work:

- the likely future trajectory in the distribution of weeds in States bordering NSW, including the potential implications of climate change on range extension, conflicting commercial plant usage and food security
- NSW Biosecurity Strategy, NSW Invasive Species Plan and NSW State-wide Framework of Biodiversity Priorities for Widespread Weeds
- arrangements for weed management in other jurisdictions
- community expectations and feedback
- previous reviews on weed management in NSW
- any reports and recommendations from the Independent Local Government Review Panel and NSW Crown Lands review
- functions and services of Local Land Services
- intergovernmental agreements for biosecurity
- any monitoring, evaluation and reporting arrangements for weeds.

The Commission should work closely with Department of Primary Industries and consult with relevant stakeholders and agencies, including Noxious Weeds Advisory Committee, Office of Environment and Heritage, NSW Aboriginal Land Council, Local Control Authorities, Local Government NSW, Catchment Management Authorities, Regional Weed Advisory Committees, Livestock Health and Pest Authorities, peak farming, industry and environmental groups and relevant Australian government bodies. The Commission will also undertake public consultation to inform its assessment and development of recommendations.

The Commission is to provide:

- a Draft Report, including draft recommendations, within six months of receiving the terms of reference
- a Final Report, including outcomes of consultation, within three months of providing the Draft Report.

Attachment 2: Summary of Issues Paper submissions

The Natural Resources Commission (NRC) invited submissions to inform its review of weed management in NSW. 206 submissions were received, and can now be accessed through the NRC website at: http://nrc.nsw.gov.au/Workwedo/ReviewOfWeedManagementInNSW.aspx

The greatest number of responses were from individuals (71), followed by Local Government organisations (councils, county councils, weed authorities, etc.) (65) and other government organisations (23). Submissions were also received from community organisations (including Landcare and Bushcare groups), environment groups, industry groups, academics and the NSW Aboriginal Land Council.

The submissions highlighted the significance of effective weed management to the community, and provided useful insights and recommendations from a range of perspectives. The following summary provides an overview of the key issues raised in the submissions, but it is not exhaustive. The focus of this summary is on the solutions and opportunities identified in stakeholder submissions, rather than a restatement of the issues, the causes and the implications.

1 Community ownership

- With respect to education and awareness many submissions noted the confusion arising from the plethora of information available regarding weed management, which is sometimes incorrect, outdated or inconsistent. Many highlighted the need for a one-stop weeds portal to allow easy access for stakeholders seeking information on weeds.
- Suggested information included weed impacts and influences, the roles and responsibilities of government agencies, regulatory responsibilities, weed identification and best practice guides for weed management and information packages for new landholders.
- Submissions emphasised the importance of delivering communication and awareness programs at a local or regional level, to take into account local conditions and knowledge, as well as existing rapport built with the community. This is supported by the suggestion that for efficiency and consistency many communications could be developed centrally, then adapted to local needs. Other submissions stated that the scale for awareness-raising programs depended on the message being conveyed and the audience being targeted.
- There is general agreement that weed education needs to be delivered across the spectrum of the community and not just to landholders, and that the message and information for each group should be targeted.
- Some of the opportunities identified to facilitate community ownerships of weeds management included:
    - highlighting the public health implications of some weeds
    - public authorities leading by example and effectively managing weeds on their own land
    - integrating weeds education into the school curriculum
    - clear information regarding the social, environmental and economic impacts of weeds on agriculture and biodiversity.

- One-on-one engagement is identified as the most effective mechanism for education and capacity building with landholders. Submissions also highlighted that many landholders felt overwhelmed by the extent of the problem and that engagement is critical to support action.
- A wide range of stakeholders identified the significant role of community groups such as Landcare and Bushcare in influencing community practices and weed management. Submissions suggested greater support (for example, financial and training support) to more effectively leverage the involvement of these community organisations. The value of initiatives such as Weed Spotters is also well recognised.
- The proliferation of subdivisions and small rural holdings is commonly identified as a source of weed issues. Often these landholders are absentee, have no knowledge of the legal obligations or have no financial imperative as the land is not being used for agriculture (commercial/ lifestyle). These landholders put a low priority on biosecurity in general, and this undermines a 'voluntary collective action' approach for widespread weeds.

Incentives and disincentives

- Submissions identified a number of opportunities to influence landholder practices and promote collaborative action within communities, including:
    - requiring sellers to disclose the weed status of properties for sale so that buyers are aware of their legal liabilities for weed control, promoting links between property value and weed status. The primary mechanism proposed is amending Schedule 4 of the *Environmental Planning and Assessment Regulation 2000* which sets out those matters to be included in a s149 planning certificate, which must be provided to a prospective purchaser with a contract for sale under s4 of the *Conveyancing (Sale of Land) Regulation 2010*.
    - requiring a weed-specific standard condition in development consents for subdivisions. For example, Eurobodalla Shire Council currently utilises a locally developed Standard Condition 12.37 (*Prior to the issue of a subdivision Certificate the applicant shall liaise with and comply with the requirements of the Council's Invasive Species Officer in relation to Part 3 Section 12 of the* Noxious Weeds Act 1993 *for control of weeds on the land*. [12.37 [0179]).
    - valuing land at the point of sale according to how much it will cost to adequately control weeds that exist. Any land sold could by law have a costed management plan detailing the maintenance cost and expected management obligations and costs. LCAs would be allowed to pass on information regarding the weed history of the property to prospective buyers.
    - developing location-specific community weed management plans with clear targets covering multiple properties (both public and private) to promote collective and peer pressure action. Collaborative actions are likely to have a higher chance of working if landowners and the public can see government authorities leading by example with respect to weed management and control.

- preparing property-level weed management plans with clear timeframes and milestones to be achieved for public and private landholders. The requirements in these plans could then form the basis for compliance actions, such as imposing costs for weed control activities that could reasonably be expected of the landowner under the plan.

- A range of financial incentives were also proposed, including differential land rating systems and rebates for substantial reductions in weed infestations due to control and management activities, and a system of valuing volunteer labour as a tax-deductable charitable donation to encourage greater volunteerism. Financial disincentives proposed included increased penalties for non-compliance.
- Other proposed incentives and disincentives were based on social drivers and included: reward and recognition for voluntary continuous improvement systems; a weed free or weed smart accreditation program; and publicly available information (such as maps) regarding the precise locations of infestations in order to create social pressure to control noxious weeds.

2 Policy and regulatory framework

- Many stakeholders highlighted the current state of confusion with respect to weed management. Submissions stressed the need to rationalise and focus the broad range of policies and strategies that cover weeds, and to clearly document the roles, responsibilities and accountabilities of those involved in weed management. This ambiguity at a policy level has led to inconsistent, and sometimes conflicting, requirements (policy, procedures, priorities) for controlling weeds being set by LCAs and public land managers.
- A number of respondents called for an "optimal smart and responsive policy mix" that which uses a variety of forms of social control and funding arrangements, and a combination of incentives and disincentives, rather than the current narrow policy approach to weed management.

<u>Policy</u>

- Submissions note an apparent misalignment between policy and regulation. In particular that the vision of the NSW Invasive Species Plan (ISP) is to protect against adverse impacts, while the legislation focuses on the management of declared noxious weeds. Furthermore, the required control measures are not always consistent with the ISP management objectives.
- A number of respondents across stakeholder groups proposed addressing environmental, 'noxious', and agricultural weeds as a single management issue in policy and legislation.
- A large number of respondents identified the need for a holistic, integrated landscape management approach to ensure effective ongoing weed management. The rationale is that weeds are a symptom of ecological decline, and generally healthy, robust areas will not be so degraded by weeds. Such an approach can apply at a property and regional scale and be supported by a long-term plan with achievable objectives for improved economic and biodiversity outcomes.
- Respondents indicated strong support for the WAP as a model for promoting a more holistic approach to weed management (rather than weed species-specific funding) and increased accountability through the associated reporting requirements.
- There is broad support for the current investment focus on preventing and eradicating new and emerging weeds.

Compliance and enforcement

- A range of stakeholders identified that monitoring and application of compliance and enforcement actions are inconsistent and ineffective between LCAs. Furthermore, the application of compliance provisions in the legislation has been very limited. Suggestions for improvement included:
  - providing greater support from state authorities when expensive control measures or litigation are required to enforce compliance
  - clearly separating LCA compliance and enforcement functions from the weeds extension advisory role, similar to the model currently in place under the *Native Vegetation Act 2003,* to ensure the confidence of participants.
- Submissions from all stakeholder groups supported increased penalties, possibly with a sliding scale for high-priority, high-risk weeds (Class 1, 2, 3).
- Some submissions suggested repealing landholder obligations to manage aquatic weeds, and allocating responsibility to a single organisation (see 'Institutional arrangements' below).
- Specific changes recommended to improve the *Noxious Weeds Act 1993* included:
  - improving the notice system by removing section 18a "Notice of Intent to Issue a Weed Control Notice" notices, particularly for high-risk weeds. This is identified as an unnecessary step which creates confusion among landholders and creates an extra administrative burden on LCAs with no significant advantage to weed control.
  - formalising re-inspection fees in the legislation.

Land tenure

- The general consensus is that public land managers should be held accountable to the same standards as private landholders and LCAs for weed management. Several respondents noted that this would require increased resourcing.
- The accountability of public land managers could be improved through annual audits and working with LCAs through consistent inspections and demonstration of on-ground weed control works.

Weed declarations and listings

- Several respondents noted their concern regarding the current weed declaration process involving the Noxious Weeds Advisory Committee and LCAs, and the potential it affords to remove or not include difficult and persistent weeds from the list because their control is deemed unachievable and/or too costly. To address the issue it was suggested that the review and declaration process be undertaken by an independent, scientific panel to avoid politicisation or regional bias.
- Submissions argued that the declaration process for new and emerging weeds is too complex and slow, and as a result species may spread or become established before action can be taken.
- Respondents also argued that the wording of the Class 4 weed declaration control requirements is too open to interpretation and does not provide sufficient legal basis to take action.

- A variety of suggestions were made to improve the listing approach for weeds, including:
  - a 'permitted', 'safe' or 'white' list detailing the plant species that can be introduced and sold in NSW
  - a single, standardised and consistent 'invasive species' list for NSW which aligns with any national lists and those of neighbouring states especially for border areas
  - aligning the listing system to the Invasive Species Plan and WAP. That is, categorising weeds where the focus is on: a) prevention or exclusion of high-risk weeds not yet present; b) eradication or containment of new and emerging weeds; and c) management of established and widespread weeds.
- A common concern is that some declared noxious weeds can be sold, and many submissions recommended that all declared weeds be prohibited from sale.
- Many submissions argue that the burden of responsibility on the commercial sector needs to be strengthened. For example, that all plants for commercial trade should be cleared for weed potential, rather than just imported plant species, and a list of plants permissible for commercial trading should be established based on the current Weed Risk Assessment system.
- Furthermore, many submissions argue that potential risk generators be held to account under the 'polluter pays' principle by requiring, for example, bonds and levies to cover costs of the risk assessment, monitoring and control of high-risk species used commercially, or those wanting to include new species, even low-risk plants, to a safe list.

Widespread vs new and emerging weeds

- It is generally agreed that regulation provides well for new and emerging weed threats, but is not so effective for widespread weeds. It is also recognised that it is not possible to allocate sufficient resources to the management of widespread weeds wherever they occur.
- The most common recommendation is for a management approach based on regionally negotiated widespread weeds plans that identify strategic goals, particularly to control impacts on high conservation or agricultural production assets.
- Such plans can be driven using a variety of mechanisms, including social motivators, financial incentives and rebates and collaborations. Non-compliance can then be managed with the option of a government agency undertaking control works and redeeming the expense.

3 Institutional arrangements

- The submissions reveal a general confusion regarding the current institutional arrangements and legislative requirements across all stakeholder groups, as evidenced by incorrect information being presented.
- There is broad backing from LCAs for the responsibility for local weed management to remain with local government. The reasons include the extensive knowledge and expertise built up in local government, along with rapport and relationships with community stakeholders; the weed funding derived from rates; the weed control equipment and resources owned by councils; the lower salaries paid by local government as compared to state government agencies; and the relative stability of local government compared to government agencies that change frequently.

- LCAs also supported the formalisation of regional weeds advisory committees.
- In contrast, a number of stakeholders suggested that the local government model is variable and inefficient, and that the functions and responsibilities of LCAs (in whole or in part) be transferred either to the new LLS or to a new authority (comprising agency, community and industry stakeholders) established to coordinate action on weeds and feral animals. The Bush Fire Coordinating Committee model was promoted by a number of respondents.
- A number of respondents suggested that the management of aquatic weeds would be more effective if a catchment approach was adopted, and management responsibility assigned to a single body/agency. The licencing requirements to apply herbicides on or over water under the *Protection of the Environment Operations Act 1993* were identified as a hindrance to landholders meeting their obligations under the *Noxious Weeds Act 1993*.
- Several LCAs advised that they felt accountability has improved and is sufficient under the WAP reporting requirements. However, many others proposed increasing accountability for performance through independent or peer auditing of funding and delivery of project actions and outcomes.
- Participants identified the WAP as being highly effective as a result of its regional approach to strategic planning and cooperation, establishing a level of accountability through reporting (although it is noted that the regional averaging screens local performance), and providing long-term certainty through five-year funding. There is also broad support for the model of regional weed advisory committees.
- Restructures and the loss of Department of Primary Industries staff, particularly Invasive Species Officers and researchers, were identified as having a significant impact on the overall capacity, knowledge and coordination of stakeholders responsible for weed management.

<u>Funding</u>

- It was generally agreed that weed management is underfunded across all areas (education, communication, research and development, monitoring and surveillance, compliance and enforcement, implementation of control activities) and that funding arrangements need to be more long term and strategic.
- Some suggest funding should be determined based on a 'standards of cover' approach (similar to that applied to bushfires) that includes measures for impacts on biodiversity and determines a fair level of contribution from government, landholders, business and industry.
- New sources of long-term funding should be investigated for weed management programs, including levies from risk creators and beneficiaries, to maximise the potential for success.

4 Evidence-based decision making

- Respondents stated strong support for standardised approaches for weed mapping, information management, and monitoring and reporting. Data is necessary to clearly demonstrate that weeds are an extremely serious threat to agriculture and native biodiversity, and evidence is essential for effective decision making across all aspects of weed management, including building confidence in program priorities, understanding impacts, and assessing the outcomes and cost-effectiveness of management actions and programs.
- Submissions note that surveillance and early response capacity should be improved to respond quickly to new weed incursions.

- Examples of effective weed management information and mapping systems included:
  - commercial software such as WeedTr@cer and Weedmap Pro
  - the Department of Primary Industries website and extranet
  - council in-house registers and mapping programs
  - airborne remote-sensing hyper spectral imagery with filter mapping algorithms
  - time lapse aerial photography
  - the Land Management Database currently used by CMAs for collating spatial data relating to on ground investment
  - MCAS-S, a multi-criteria analysis spatial data tool
  - Atlas of Living Australia
  - the Bushfire Risk Information Management System style of electronic database/portal
  - stakeholder identification, for example, exhibiting local maps at local events and asking landholders to record known infestations
  - weeds GIS smart phone apps for weed reporting, mapping, and identification.
- Examples of standardised monitoring, evaluation and reporting included:
  - MERV (Monitoring and Evaluation of the Restoration of Vegetation)
  - Reflect
  - MERI (for example the Riverina MERI plan for WAP).

5 Research and development

- There was general consensus that funding for weed R&D is nowhere near sufficient considering the impacts and potential impacts of weeds, and that funding has been declining for the past 15 to 20 years. Submissions stated this was likely to have a long-term impact on our ability to develop best practice and maintain an effective knowledge base.
- The two factors identified for the decline in weed R&D were the loss of the Cooperative Research Centre for Weed Management and a significant reduction in DPI research capabilities as a result of restructures. There was support for a national weed research facility.
- Submissions agreed that strategic, long-term funding is required and that research initiatives should be coordinated at a state level, through the DPI, with input from all stakeholders to identify topics and priorities. The involvement of LCAs and landholders in research trials was proposed to increase the value of research outcomes and facilitate adoption and dissemination.
- Suggested research priorities included Integrated Pest Management techniques to target high-priority species, understanding the ecology and spread of new and emerging weeds, biological control agents, weed pathways, and the potential effects of climate change on weed threats and spread.

Attachment 3: Record of consultation

Review meetings

Date	Organisation/Representatives
10 September	NSW Weeds Officers Association Presentation to Association meeting at the 17th NSW Weeds Conference and meeting with representatives
11 September	Hawkesbury River County Council and New England Weeds Authority
27 September	Biosecurity and Resources Working Group of the Primary Industries Ministerial Advisory Council
30 September	Issues paper workshop - participant list below
10 October	LLS Regional Biosecurity and Emergency Service Managers
15 October	Australian Weeds Committee research workshop CSIRO, State & Commonwealth agencies, RDCs
17 October	Presentations to review Steering Committee: DPI, Biosecurity NSW, NSW Weeds Officers Association, National Parks and Wildlife Service
18 October	Meat and Livestock Australia
21–22 October	Regional tour - Mid-north coast and New England ▪ Mid-north coast regional weed coordinating committee, and weed officers of constituent councils ▪ National Parks and Wildlife Service ▪ New England Weeds Authority ▪ Northern Inland Weeds Advisory Committee ▪ New England Landcare ▪ DPI
23 October	Noxious Weeds Advisory Committee: NSW Farmers; Landcare; OEH; Southern Rivers CMA; Nature Conservation Council
29 October	Linear Reserves Focus Group Meeting ▪ Senior Environmental Officer - Ausgrid ▪ Client Liaison and Environment Manager - Roads and Maritime Services ▪ Institute of Public Works Engineering Australia NSW ▪ Local Government NSW ▪ Nature Conservation Council ▪ Executive Officer - Roadside Environment Committee
30 October	Forestry Corporation of NSW

Date	Organisation/Representatives
5-6 November	Regional tour – South east and Monaro ▪ Bega Valley Shire Council ▪ Eurobodalla Shire Council ▪ Towamba Landcare ▪ Bega Valley Fireweed Association Southern Rivers CMA ▪ Monaro Regional Weed Advisory Committee ▪ NPWS ▪ DPI ▪ Cooma-Monaro Shire Council ▪ Snowy River Shire Council ▪ Bombala Council ▪ Towamba Landcare ▪ Maclaughlin River Landcare ▪ Snowy River Interstate Landcare ▪ Local landholders
7 November	Regional tour – Western Sydney ▪ Hawkesbury River County Council ▪ NPWS
8 November	Meeting with OEH on distribution and abundance of weeds and weed control orders
8 November	CMA Chairs Council
11 November	Australian Weeds Committee
11 November	Department of Agriculture Biosecurity Policy Division
11 November	Department of Agriculture Sustainable Resources Management Division
11 November	NSW Aboriginal Land Council
13 November	NSW Treasury
13 November	Public Land Managers - Focus Group Meeting ▪ NSW Crown Lands ▪ Forestry Corporation of NSW ▪ Sydney Catchment Authority ▪ State Water ▪ Office of Environment and Heritage
22 November	NSW Environmental Trust
25 November	Nursery and Garden Industry NSW & ACT
28 November	Western Lands Commissioner and NSW Crown Lands
3 December	National Parks Advisory Council

Date	Organisation/Representatives
4 December	Regional Tour - Orange ▪ Mid-Western Regional Council ▪ Orange City Council ▪ Lachlan Landcare ▪ Eastern Riverina Noxious Weeds Advisory Group ▪ DPI Emergency Operations ▪ Rural Fire Service ▪ NPWS ▪ Local landholders ▪ Lachlan Valley Weeds Advisory Committee
9 -10 December	Regional Tour - Lightning Ridge and Walgett ▪ Lightning Ridge Mining Association ▪ Glengarry Grawin Sheep Yards Miners Association ▪ NSW Farmers ▪ Western Lands Advisory Council ▪ Crown Lands ▪ Western Lands Commission ▪ Walgett Shire Council ▪ NPWS ▪ DPI ▪ Macquarie Valley Weeds Advisory Council ▪ Namoi Catchment Management Authority ▪ Western Catchment Management Authority
12 December	Sydney Trains
6 February	Local Land Services

The NRC consulted with various NSW, local and Australian government agencies, organisations and groups throughout the review, as shown in the table below.

NSW Government
▪ Department of Primary Industries, Biosecurity NSW
▪ Office of Environment and Heritage, National Parks and Wildlife Service
▪ Primary Industries Ministerial Advisory Council (Biosecurity and Resources Working Group)
▪ National Parks Advisory Council
▪ State Water
▪ Roads and Maritime Services
▪ Forestry Corporation of NSW
▪ NSW Aboriginal Land Council
▪ Sydney Catchment Authority
▪ NSW Crown Lands Division
▪ NSW Environmental Trust
▪ Transport NSW
▪ Rural Fire Service
▪ Sydney Trains
▪ Local Land Services
▪ CMA Chairs Council and individual Catchment Management Authorities
▪ Livestock Health and Pest Authorities
▪ Western Lands Commission
Local government (see also table of review meetings)
▪ Local Government NSW
▪ Local Government Managers Association
▪ Weed Action Program project officers
▪ Far North Coast Weeds
▪ New England Weeds Authority
▪ Hawkesbury River County Council
▪ Bega Valley Shire Council
▪ Eurobodalla Shire Council
▪ Cooma-Monaro Shire Council
▪ Snowy River Shire Council
▪ Bombala Council
▪ Mid-Western Regional Council
▪ Orange City Council
▪ Walgett Shire Council
Australian Government
▪ Australian Weeds Committee
▪ Department of Agriculture
▪ Department of Environment
Other jurisdictions
▪ Queensland Department of Primary Industries
▪ Primary Industries and Regions South Australia

Other organisations (see also table of review meetings)
▪ Weed Officers Association
▪ NSW Farmers
▪ Landcare NSW
▪ CSIRO
▪ Invasive Species Council
▪ Rural Industries Research and Development Corporation
▪ Australian Fodder Industry Association
▪ Meat and Livestock Australia
▪ Nursery & Garden Industry, NSW & ACT
▪ Institute of Public Works Engineering Australia NSW
▪ John-Holland Country Regional Network
▪ Australian Rail Track Corporation
▪ Nature Conservation Council
▪ Roadside Environment Committee
▪ Bega Valley Fireweed Association
▪ Towamba Landcare
▪ Maclaughlin River Landcare
▪ Snowy River Interstate Landcare
▪ New England Landcare
▪ Lachlan Landcare
▪ Mid-north Coast Weeds Coordinating Committee
▪ Northern Inland Weeds Advisory Committee
▪ Monaro Regional Weed Advisory Committee
▪ Eastern Riverina Noxious Weeds Advisory Group
▪ Lachlan Valley Weeds Advisory Committee
▪ Macquarie Valley Weeds Advisory Committee
▪ Royal Botanic Gardens
▪ University of Canberra
▪ University of New England

Workshop participants

Name	Organisation
Dr John Keniry AM	Natural Resources Commission
Cr Reg Kidd	Noxious Weeds Advisory Committee
Dr Bruce Christie	Biosecurity NSW
Mick O'Flynn	Office of Environment & Heritage
Sally Barnes	Office of Environment & Heritage
Pam Green	Southern Rivers Catchment Management Authority
Jim Willmott	Far North Coast Weeds
Chris Dewhurst	Hawkesbury River County Council
Susy Cenedese	Local Government NSW
Cr Maria Woods	Local Government NSW, New England Weeds Authority
Peter Turner	Office of Environment & Heritage
Rob Dulhunty	Landcare NSW
Prof. Bruce Auld	Charles Sturt University
Michael Danelon	Nursery and Garden Industry NSW and ACT
Terry Schmitzer	Mid North Coast Weeds Co-ordinating Committee
Wayne Deer	New England Weeds Authority
Dr Jeanine Baker	Department of Agriculture, Fisheries and Forestry
Cheryl Kalisch Gordon	Grain Growers Limited
Lorraine Wilson	NSW Farmers
Mitchell Clapham	NSW Farmers
Daryl Lawrence	Crown Lands Division of NSW Trade & Investment
Andrew Cox	Invasive Species Council
Prof. Deirdre Lemerle	Charles Sturt University
Rob Ferguson	Eastern and Western Riverina Noxious Weeds Advisory Groups
Rory Treweeke	Western Catchment Management Authority
Reece Luxton	NSW Weeds Officers Association, Clarence Valley Council
Robert Freebairn OAM	Agricultural consultant
Bob Makinson	Royal Botanic Gardens
John Tracey	Biosecurity NSW
Syd Lisle	Biosecurity NSW
Stewart Thompson	NSW & ACT Serrated Tussock Working Party
Robert Quirk	NSW National Parks and Wildlife Service
Mel Hall	NSW National Parks and Wildlife Service
Dr Andrew Leys	Former National Parks and Wildlife Service
Anne Herbert	Bega Valley Shire Council
Chris Scott	Landcare NSW
Tim Johnston	Livestock Health and Pest Authorities State Services
Bob Lawrence	Office of the Minister for Primary Industries

Name	Organisation
Andy Sheppard	CSIRO Biosecurity Flagship
Dave Anthony	Auscott Limited