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Weed R&D Analysis and Prioritisation

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Abstract

This project developed a discussion paper as a basis to inform discussion among producers, researchers (CSIRO, State agencies and University sector), Federal and State government agencies, to shape a draft national weeds investment framework as an input resource to the weeds planning workshop, to subsequently inform weed RD&E investment.

The discussion paper outlines a starting position for a broadly based grazing industries RD&E strategy. It provides a logical framework from a vision statement through to several recommended strategies, and challenges the weed RD&E community to engage more strongly with the grazing industries and focus more strongly on the specific issues associated with weed management within a livestock production enterprise.

This discussion paper argues that the ‘management’ of multiple weed challenges within grazing systems is a complex issue for livestock producers and therefore two approaches are needed for weed RD&E.

Executive summary

A discussion paper was developed that outlined a starting position for a broadly based grazing industries weed RD&E strategy. It presents a straw man or discussion starter that focuses only at the strategy level and does not attempt to suggest priorities for individual projects. It provides a logical framework from a vision statement through to several recommended strategies, and challenges the weed RD&E community to engage more strongly with the grazing industries and focus more strongly on the specific issues associated with weed management within a livestock production enterprise.

This discussion paper argues that the 'management' of multiple weed challenges within grazing systems is a complex issue for livestock producers and therefore two approaches are needed for weed RD&E. Firstly the traditional focus on the identification of the most important weeds, an understanding of their ecology and the development/delivery of biological, chemical and other control options. Secondly, a focus on the complex ecosystems that are grazed pastures and where the integration of multiple weed challenges and the trade-offs associated with the multiple outcomes being sought by the producer (ie both the paddock and the enterprise needs) have to be considered, as well as an understanding of the attitudes and motivations of the producer.

Three outcomes are suggested:

1. Increased capacity and confidence of livestock producers to include weed management in the multiple strategies that are associated with grazed paddocks;
2. Increased profit from meat and wool production because of a lower impact from weeds in grazing systems; and
3. Reduced risk of new weeds or of increased weed burdens in existing grazed systems.

Five strategies are suggested:

a) Join with the major/national weed strategies and weed R&D funding arrangements to ensure a focus on grazing industries issues and to leverage industry funds;

b) Develop an effective system to link weed R&D with the individual paddock needs of livestock producers;

c) Focused R&D to support the development/improvement of the delivery system in b) as there will be many gaps;

d) Producer initiated R&D with a weed-management-within-productions-systems focus to engage the industry into the R&D process and to demonstrate effective weed management;

e) Industry specific R&D on surveillance & sleeper or emerging weeds likely to impact on the grazing industries.

The rationale and the key assumptions behind the vision, the outcomes, the outputs and the strategies forms the main body of this paper.

The discussion paper recommends:

- Wide circulation of this paper to stimulate thinking and debate in the lead-up to the industry workshop.
- That the workshop accepts/rejects/amends the straw man as appropriate until there is broad agreement on the strategic framework for weed focussed grazing industry RD&E.

Once a strategic framework is agreed, the workshop can then progress to identifying the priorities and projects to deliver into the framework.

Appendix 1 Draft weed investment framework

Draft Discussion Paper

A Weed RD&E Investment Framework for the Grazing Industries

July 2012

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A Weed RD&E Strategy Framework for the Grazing Industries

1. Purpose of this discussion paper

This discussion paper is designed as background to a broadly based grazing industries workshop with producers, researchers, R&D funders who have a strong interest in weeds. It presents a straw man or discussion starter that puts some ideas and suggestions on the table for individuals and organisations to agree with, disagree with, modify etc through the workshop process. Once agreement on the strategy framework is reached, the R&D Corporations then have a strong basis for aligning industry funding with clearly agreed strategies and priorities.

This discussion paper is not/does not:

- A review of the weed science literature as it might relate to the grazing industries in Australia[1];
- Provide commentary on the importance or priority of individual weeds to the grazing industries[2];
- Account directly for the priorities and needs of others with a major stake in Australian weeds (ie other agricultural industries and environmental groups)[3];
- Attempt to identify regional or institutional capacities and limitations with respect to weed R&D[4]:
- Enter the debate about the overall cost of weeds to Australia or to the grazing industries but simply assumes that the opportunity for the industry to gain from improved weed management is substantial[5];
- Suggest priorities at the project level.

This discussion paper does/tries to:

[1] There are many general and specific weed reviews that cover this topic

[2] The extensive review by Tony Grice (Weeds of significance to the grazing industries of Australia) is still current. This review has been used as the basis for setting the weed R&D priorities for the northern cattle industry and for southern grazing systems, while several authors (eg Brian Sindel, Mark Trotter, Leslie Weston) have developed priority lists for more specific agro-ecological regions.

[3] GRDC and RIRDC have major weed R&D programs in addition to the WONS process.

[4] The Situation Analysis and Options Paper developed by Leslie Weston for the RMCiC has attempted this.

[5] In 2011 John Thorpe prepared a review for MLA entitled “Cost of weeds – ranking weeds of importance to the grazing industries”

- Focus specifically on the challenges associated with weeds in grazing systems. This is suggesting that as well as the traditional approach of identifying high priority weeds and then working towards understanding and control, we need to add a process where we start with the grazing system context and work backwards towards weed management or control;
- Be broad enough to account for production systems that range from tropical rangelands with few or no options for paddock based interventions, through to intensive systems in fertile, high rainfall, southern systems with many paddock intervention options;
- Challenge the weed RD&E community to engage more strongly with the grazing industries and focus more strongly on the specific issue of weed management within a livestock production enterprise as well as on traditional weed control;
- Builds on the paper by Leslie Weston (see footnote 4 - Situation Analysis and Options Paper for the RMCiC) that provided a situational analysis of Weed R&D to assist where MLA investment may be most appropriate given what has been done, is underway and is required for the livestock industries;
- Provides a logical framework from a vision statement through to several recommended strategies rather than suggesting priorities for individual projects or for individual weeds. Once modified/accepted by the industry, this framework will guide the development of projects to deliver on the industry strategy.

2. Background and Context

There is a rich history of weed RD&E in Australia, with most recently, 2 CRC's and 2 national strategies that collectively produced some excellent outputs, and all are now completed. This history of RD&E provides a strong basis for now examining how to improve weed management in the grazing industries through extension of existing knowledge and further research.

Grice 2004 has identified weeds of significance to the grazing industries and this has been a basis to define focus and need (biological control, management or ecological studies, or simply delivery of known technologies). In the southern Feedbase R&D Plan[6] Weeds and Biodiversity is one of the 5 pillars (with Pasture Breeding & Evaluation, Productive & Sustainable Pastures; Grazing Management and Production Systems, and Decision Tools) but specific weed RD&E priorities have not been set, pending this workshop process.

In northern Australia, MLA funding for research has been preferentially directed towards the priority weeds Parkinsonia, Bellyache Bush, Lantana, Sida, Hyptis, Tobacco Weed, and Sicklepod. Demonstration and extension activities have been focussed towards Giant Rat's Tail Grass, Giant Parramatta Grass, Rubbervine and Mesquite.

[6] R&D for the meat industry in southern Australia (Mason and Allan, 2011)

In much of northern Australia, paddock based interventions are not practical, making biological control a major focus.

Weeds are important in the grazing industries but rank well down on the priority list for both extension (figure 1) and research (figure 2)[7]. These figures are from southern Australia, including southern Queensland and may be different for the tropical north.

One interpretation of these ratings is that unlike cropping where total weed control is often the objective, weeds are in fact a 'normal' component of almost every pasture, whether native or improved and weeds are therefore not seen as quite so important. Most pastures are a mixture of desirable (sown or native), less desirable and undesirable species; with the less and undesirables ranging from noxious weeds to plants that are sometimes weeds and sometimes make a significant contribution to the feed supply. There are hundreds of these 'undesirable' species[8] which has led some to suggest that instead of trying to pick individual weeds, a better way to focus weed RD&E might be on functional groups such as unpalatable grasses, broadleaf weeds, or summer perennial weeds etc.

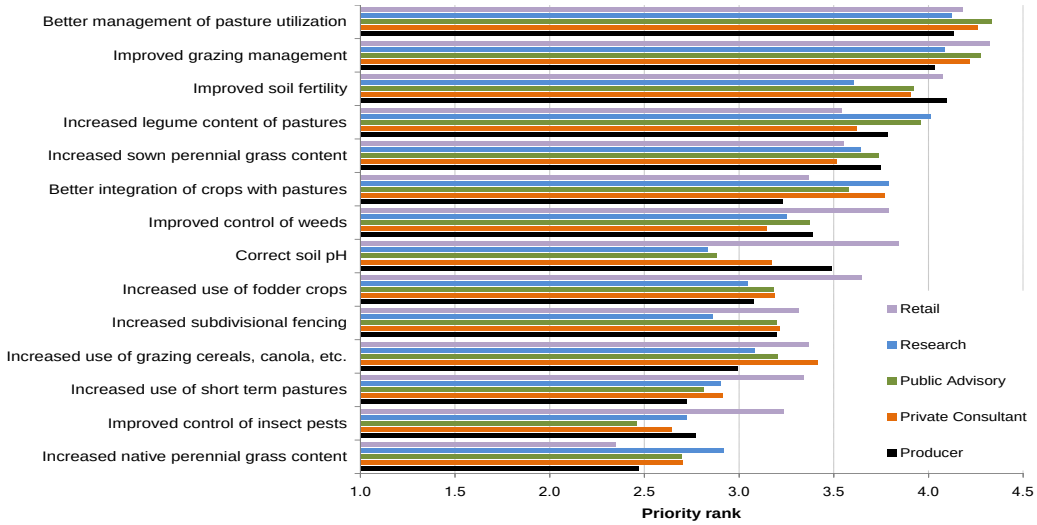

Figure 1. Priority for on-farm actions that if undertaken would increase red meat production. There were no differences in the priority for weeds across the agroecological zones.

[7] These figures are drawn from the MLA Feedbase Investment Plan (Shovelton et al 2011) and are the result of a comprehensive survey across all the key sectors of the industry.

[8] In the survey undertaken by Mark Trotter (PhD thesis) southern producers reported 328 undesirable species

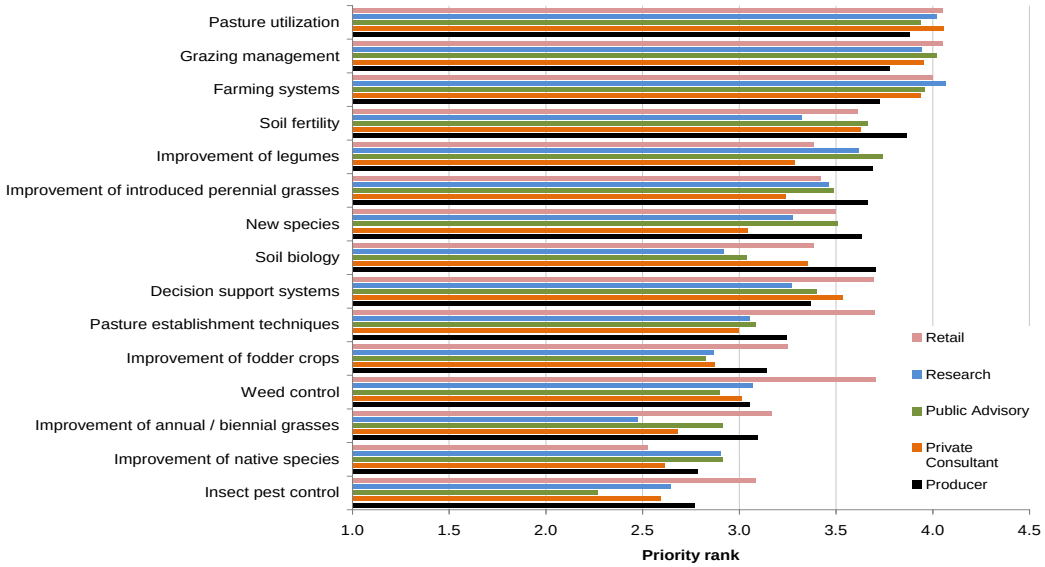

Figure 2. Priority components of the feedbase requiring research to increase red meat production. As with extension needs in figure 1 there were no major differences between agroecological zones.

The most recent attempt to focus weed RD&E for the grazing industries (southern) was undertaken by Leslie Weston at CSU- see footnote 4. Paraphrasing, this report recommended that MLA:

1. Address the lack of national funding by developing a focused strategic planning process;
2. Coordinate new research with pre-existing work; and
3. Focus new research activities towards surveillance and impact assessment; bio-control in concert with IWM; increasing pasture competition to reduce weeds; biology of recent weed incursions; and weed management in production systems.

The report also said "*By taking a new approach to the study of weeds in feed-based systems, rather than asking only questions in one dimension the weeds research initiative could more fully embrace investments in research upon feedbase systems".* This is a suggestion worth pursuing.

This discussion paper (see Section 3, the logical framework) argues that the traditional approach of identifying weeds of local or national importance and researching their biology and control has aligned more effectively with the weed control R&D needs associated with cropping systems, with environmental weeds and for the northern grazing industry than it has for southern pasture systems. We need to balance this weed-first focus with a parallel approach that starts with the context of a paddock based pasture ecosystem with multiple producer objectives and containing multiple weeds of varying 'undesirabilities' and at different levels of 'infestation' and work backwards to the issue of weed management. The essential question is on which issue (weeds, fertility, pests, diseases, infrastructure, animals etc etc) and in which paddock is the best place to spend the marginal input dollar to achieve the best enterprise level benefit.

3. The Logical Framework

The following logical framework is proposed for discussion at the 'weeds in grazing systems' workshop. The framework is summarised in Figure 3 and detailed below. There are many limitations with a 2 dimensional diagram, so only some of the key arrows are included to indicate the general trend from projects to the vision – for example, strategies a and b would be expected to deliver strongly to output iv but they are too far away to link with arrows and there are no feedback loops included.

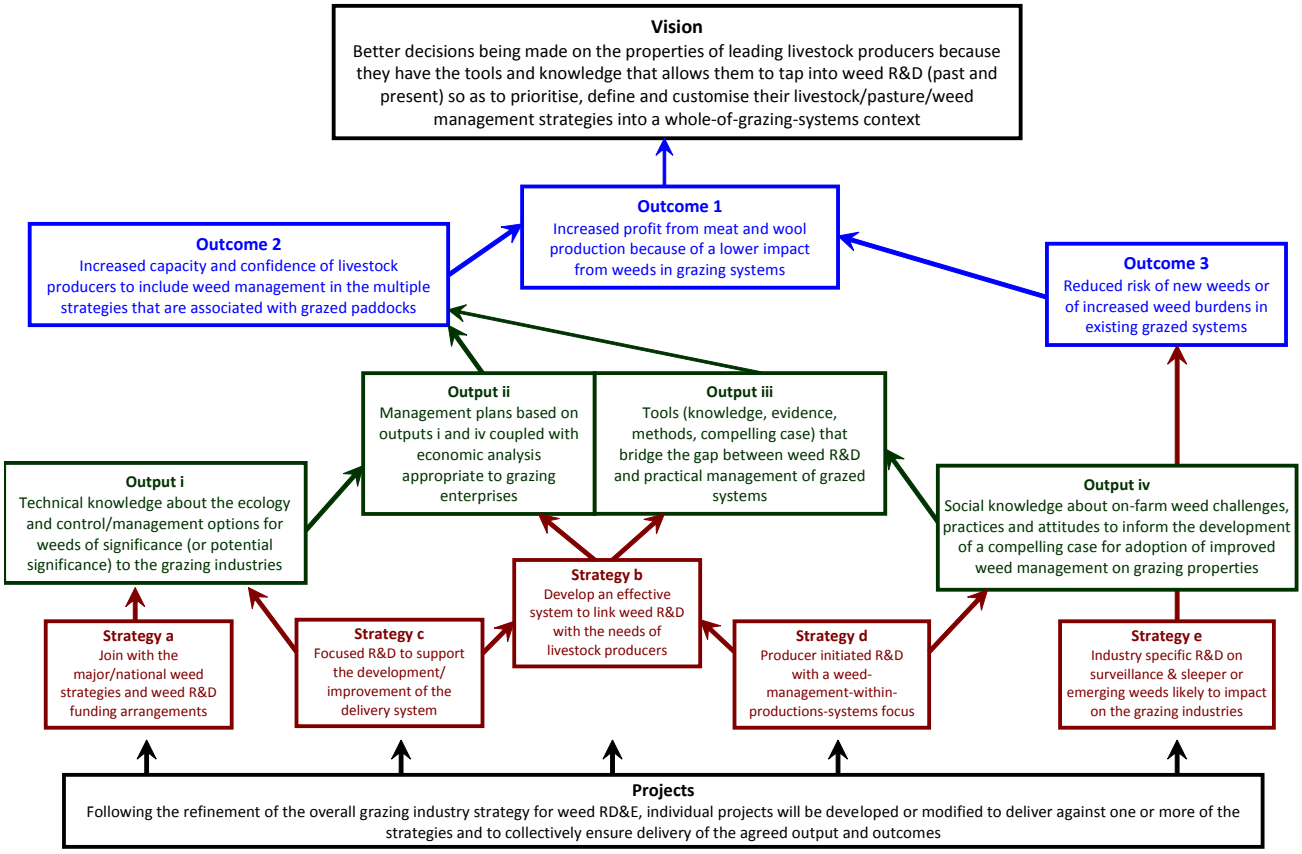

Figure 3. A conceptual flow of logic linking individual RD&E projects with the vision of better decisions being made on the properties of leading livestock producers.

3.1 The Vision:

Better decisions being made on the properties of leading livestock producers because they have available the tools and knowledge that allows them to tap into weed R&D (past and present) so as to prioritise, define and customise their livestock/pasture/weed management approaches. The key issue is that a grazing systems focus is required and this focus is the context into which weed management decisions must fit.

Rationale and key assumptions:

This vision tries to account for the fact that except in specific circumstances, such as the spot spraying of noxious weeds, grazing "paddocks" are complex ecosystems that are managed for multiple outcomes. The primary objective is usually profitable livestock production, but one of the other outcomes being sought might be the prevention of weed build-up or the reduction of overall weed load.

It assumes that leading livestock producers cannot 'easily' tap into the R&D information and customise a paddock based, rather than a weed based, management plan and that they would improve their 'performance' in weed management if they could.

3.2 The Outcomes

outcome 1. Increased capacity and confidence of producers in the grazing industries to include weed management in the multiple strategies that are associated with grazed paddocks. The confidence and capacity will be derived from the addressing of knowledge gaps, building the supporting evidence, methods for customising paddock management plans, and the development and demonstration of a compelling case for action.

Rationale and key assumptions:

Grazing paddocks are complex ecosystems managed for multiple outcomes and total weed removal is rarely a desired or even remotely possible outcome. Instead the outcome sought is to have producers able to include effective weed management as part of the mix of a productive grazing business.

It does not assume that increased confidence and capacity will automatically lead to less weeds in pasture systems, only that clearer and more evidence based decisions will be made.

outcome 2. Increased profit from meat and wool production because of a lower impact from weeds in grazing systems. The increased profit may come from reduced weed control costs or from increased returns from animal production.

Rationale and key assumptions:

While there are NRM and social issues and responsibilities associated with weeds the primary outcome being sought from industry investment needs to be more profitable grazing systems. It assumes that without the promise of increased profit, changes in weed management practices will be lowly or slowly adopted. There are other funders of weed RD&E that are more specifically focussed on the social and NRM issues so these important considerations are not ignored.

outcome 3. Reduced risk of new weeds invading grazed pastures, of minor current weeds becoming more prominent, or of existing weeds increasing their competitiveness in pasture systems.

Rationale and key assumptions:

Many weed studies have indicated that return on investment is greater for weed prevention than for weed control - therefore weed surveillance and the identification of and study of 'emerging' weed threats is a critical component of any industry strategy. While current weeds are the current challenge for producers and provide the mechanism to engage producers into the weed RD&E discussion, part of any industry weed strategy should be to identify the changing environment and the subsequent emergence of sleeper weeds.

The Outputs

output i. Increased technical knowledge about the ecology and control/management options for weeds of significance (or potential significance) to the grazing industries. This technical knowledge must include individual and multiple weed 'reduction and trade-off' strategies within livestock production systems as well as thresholds/triggers to stimulate action.

Rationale and key assumptions:

There is an ongoing need to ensure that we understand the ecology of weeds, individually and collectively in grazing systems; the potential mechanisms for management or control; the appropriate thresholds for action; and the costs/benefits of bringing the individual weed or total weed load to an acceptable level of infestation. It assumes that an 'acceptable level of infestation' is often a more appropriate aim than total weed control, and is based on optimising livestock production and profit rather than weed control per se.

output ii. Management plans based extensively on outputs i and iv, coupled with economic analysis across time and on different production enterprises, focussed towards paddocks where modification of the overall management mix can deliver effective and profitable weed control outcomes.

Rationale and key assumptions:

This output aims to recognise that most weed R&D has focussed on single, important weeds whereas livestock producers face multiple weed incursions into every paddock. Therefore, while a well constructed single weed management strategy is highly likely to reduce that weed, producers are more likely to engage in the weed management process if there is a coherent plan to address the collective weed problem in his/her paddock, and that weed plan is capable of integrating the full gamut from noxious weeds with (say) zero tolerance, through to sometimes-useful but less desirable species. Every combination of producer and paddock challenge is unique so a specific and paddock based plan will be more appealing to producers. It is assumed that a balance of approaches to the overall weed spectrum in the pasture will be more effective and more attractive to producers.

output iii. Tools that bridge the gap between weed R&D and practical pasture paddock management. These tools need to combine the technical knowledge (ie the understanding of weed ecology, the evidence for cost effective control, and the control/management methods) with the understanding of producer capabilities

and motivations to deliver a compelling case for producer intervention where it is justified, and freedom to focus on other farm challenges where it is not.

Rationale and key assumptions:

The vast majority of weed extension material has a single weed focus – indeed for important weeds such as serrated tussock there are entire books written about ecology and control. This output assumes that the real challenge for livestock producers is more often about keeping the total paddock weed load down to acceptable levels while applying some mix of weed reduction and pasture strengthening strategies but without losing sight of the main game – ie profitable animal production. The grazing industries have not been well provided with such tools – tools that are essential for developing the management plans in output ii.

output iv. Social knowledge about on-farm weed challenges, current management/control practices, and the information/motivation needs to develop a compelling case for adoption of improved weed management/control on grazing properties.

Rationale and key assumptions:

Weed control in complex pasture mixes is very easy to put into the too-hard basket, so that while weed R&D and farm surveys conclude that weeds are a major cost to the grazing industries, the priority put on weed management is often low both at the individual property level and in industry wide surveys of RD&E needs. The assumption underlying this output is that understanding the social context into which weed management strategies have to fit is equally important as understanding the technical issues, and that this social understanding has not been given sufficient priority in previous weed R&D programs.

3.3 The Strategies

strategy a) Join in with any major/national weed strategies and weed R&D funding arrangements such as the recent CRC's and national weed strategies. This is to identify the opportunities for co-investment in projects relevant to the grazing industries and to ensure linkages between national programs/projects and specific grazing industry challenges as well as grazing industry funded RD&E.

Rationale and key assumptions:

This strategy is a no-brainer. Industry engagement with (and potentially co-funding into) national weed strategies and funding arrangements is essential to improve the focus of those strategies on grazing industry weeds, to ensure a strong linkage (information flow) between these national strategies and any specific grazing industries activities associated with weeds, and to potentially leverage industry funds into larger projects.

strategy b) Develop an effective process or processes to ensure that weed related R&D (past and current) engages with and is linked to the needs of livestock producers. This framework or process must support the presentation of knowledge, evidence, methods/management plans and build towards a compelling case for action or practice change.

Rationale and key assumptions:

There is a large volume of existing research information on numerous weeds, including most of the weeds of major importance to the grazing industries. Establishing a framework into which that R&D of relevance to livestock producers can be placed to support the compelling case for adoption is required. Historically there has not been a strong connection between weed R&D and on-farm paddock management decisions. Put another way, there is no current framework that makes it easy for current and past weed R&D results to be incorporated into on-farm/paddock based decision making and this is a major priority for the grazing industries.

My personal conclusion is that a significant effort to develop a web based tool to assist producers and their advisors should be undertaken. Though not exact analogies, Pest Genie and Saltland Genie are examples of effective web delivery of context specific advice. Note though that when I googled 'weed genie' I came across quite a different and less legal 'weed' activities.

strategy c) Focused R&D to support the initial development and the on-going improvements that will be needed to underpin strategy b).

Rationale and key assumptions:

The first attempt at developing "an effective process or processes to ensure that weed related R&D (past and current) engages with and is linked to the needs of livestock producers" will have many information gaps and technical and social weaknesses. That is, the information that livestock producers will need for paddock based decision making in the presence of multiple weeds and multiple paddock objectives will be incomplete. Industry funding should be strongly skewed in the short term to filling those gaps – but importantly, the existence of those gaps should not be allowed to delay the first attempt at strategy b.

strategy d) Producer initiated R&D with a weed-management-within-production-systems focus.

Rationale and key assumptions:

It is well established in the grazing industries that RD&E programs gain higher and more rapid adoption when they are strongly connected to industry and are carried out within the context of on-farm management. Consequently, the grazing industries have a history of providing funds to producer groups who wish to explore R&D questions within their collective production systems. It is assumed that such engagement of producers will provide similar advantages in the development and demonstration of the weed management strategies envisaged in strategy b.

strategy e) Grazing industry specific R&D on surveillance & sleeper or emerging weeds that seem likely to impact on the grazing industries in the future.

Rationale and key assumptions:

Because of changing/emerging weed threats, changing climates, changing production systems, changing management practices and changing weed control options it is not sufficient for a grazing industry strategy to focus only on the current weed threat. While most industry funding should be directed to assisting with the control/management of weeds that are currently impacting on the grazing industries, some proportion of funding should be allocated to weed surveillance and the study of sleeper, or emerging weeds.

4. Conclusions and Recommendations

It is clear from the development of this discussion paper that the 'management' of multiple weed challenges within grazing systems is a complex challenge for livestock producers. It is also clear that we need more than one strategy. We need the traditional approach – ie a focus on the identification of the most important weeds, an understanding of their ecology, and the development/ delivery of biological, chemical and other control/management strategies. I call this a weed-first approach.

In addition, we need a different strategy, one that takes the somewhat opposite approach of starting with the complex ecosystem that is a grazed pasture, that draws from the underpinning knowledge from the weed-first strategy, and that integrates the multiple weed challenges, the multiple outcomes being sought by the producer (ie both the paddock and the enterprise needs) and accounts for the attitudes and motivations of the producer. This second approach appears to have been under-done for the grazing industries.

Therefore I recommend:

- That this discussion paper be widely circulated to stimulate thinking and debate in the lead-up to the industry workshop.
- That the industry workshop develops a strategic framework for grazing industry investment into weed management. This paper provides a starting (or straw man) framework for the workshop to accept/reject/amend as appropriate.
- Once there is agreement by the workshop participants on the appropriate framework for the industry strategy, then debate can begin on priorities and projects within the agreed strategies so as to ensure a portfolio of investments that collectively deliver on the agreed outputs and outcomes.