



UNIVERSITY
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AUSTRALIA

Understanding social attitudes related to the success of area-wide weed management

PRELIMINARY FINDINGS FROM CROPPING REGIONS ACROSS AUSTRALIA

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Introduction

Weeds are one of Australia's most persistent agricultural and environmental challenges. The mobility of weeds, biological controls and herbicide resistance, means that weed management is a landscape-scale problem that requires community-wide solutions.

The need for weed management to work effectively across property and institutional boundaries, means that an in-depth understanding of the attitudes, practices and relationships of various actors involved in weed management is needed.

During 2020, over 80 growers, agronomists, consultants, contractors, extension officers, biosecurity officers and public land managers were interviewed as part of this social research project.

The aim of the interviews was to:

- learn about the diverse attitudes towards area-wide management of weeds in cropping systems.
- identify factors that explain participation in individual and area-wide management of weeds
- identify social costs and benefits of area-wide management of weeds and related practices

While the focus of the project was on three case study regions—Darling Downs, Queensland, Riverina, NSW, and Sunraysia, Victoria—interviews were also undertaken with people living and working in other Australian cropping regions who had experience with area-wide management of weeds.

This report provides a summary of the preliminary results from the additional interviews, half of which were from the Gwydir catchment in NSW. For more information about the project please contact: sgraham@uow.edu.au

Method

Nineteen people from beyond the case study regions participated in phone interviews between August and December 2020. Nine were from the Gwydir catchment. The remaining ten interviewees were from:

- New South Wales (Macquarie Catchment, Namoi Catchment, Northern Rivers Catchment)
- Victoria (Mallee Catchment)
- Western Australia (Wheatbelt, South Coast and South West)
- South Australia
- Tasmania

Three of the participants are growers, four work for regional or state government agencies, twelve are involved in project management, information provision and advice (including agronomists, consultants, industry extension officers, Landcare coordinators and researchers).

The interviews involved open-ended questions about interviewees' experiences with and perceptions of: the most concerning weeds in the region; the key issues surrounding the

management of weeds; perceptions regarding area-wide management of weeds; and the future of weed management.

This document presents the preliminary findings of the interviews. No detailed analysis of the data is presented nor conclusions drawn. That will be conducted in the next stage of the project.

Weeds of most concern

Interviewees were asked to identify the three weeds of most concern to them. In response to this question, interviewees identified 26 weed species that they were concerned about.

The six weeds that were most commonly mentioned as being of concern (in order of the frequency with which they were mentioned) were: Feathertop Rhodes grass (8), barnyard grass (7) ryegrass (5), milk thistle (4), fleabane (4) and skeleton weed (3) (Figure 1 and Figure 2).

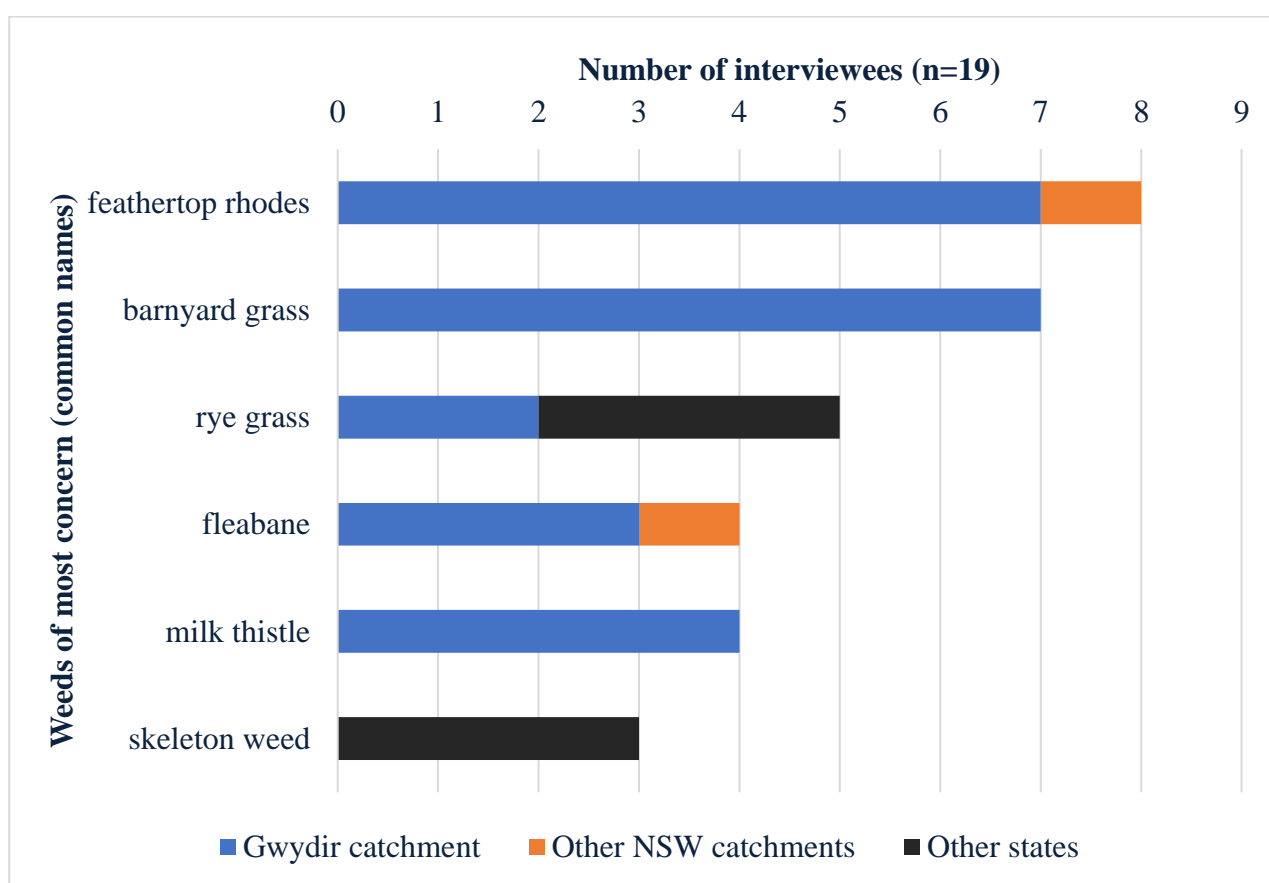


Figure 1. Number and region of interviewees who identified each weed as being in their top three weeds of most concern. Only weeds that were mentioned by at least three interviewees are included in this figure. The rest of the weeds were mentioned by one or two participants (Tables 1 and 2).

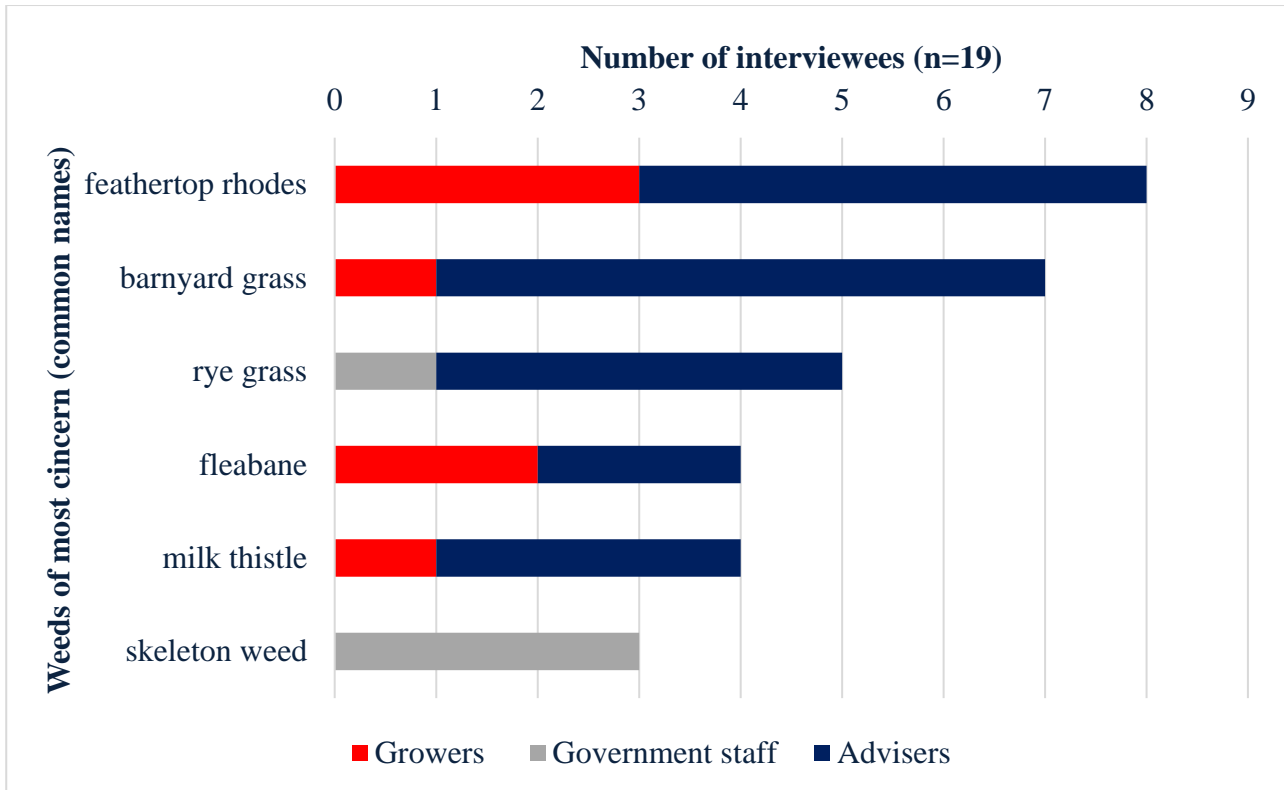


Figure 2. Number and occupation of interviewees who identified each weed as being in their top three weeds of most concern. Only weeds that were mentioned by at least three interviewees are included in this figure. The rest of the weeds were mentioned by one or two participants (Tables 1 and 2).

The reasons why the top six weeds were considered to be particularly concerning were:

1. **FEATHERTOP RHODES GRASS.** Is widespread, now covering large tracts of Queensland and NSW as well as spreading into Victoria and South Australia. It has blown in with the dust storms in the last few years. It is ‘relatively tolerant to glyphosate’ and has also developed resistance to glyphosate. The timing of when it germinates (how early it can emerge and the small amount of rain required to germinate), how prolific it is (producing thousands of little seeds), how easily the seeds can spread, and how it can ‘sit there and survive’ makes it difficult to control in cropping systems.

The other thing with Feathertop is when you're in the heat of the battle in the summer season, fallow spraying and whatnot, it gets very difficult to control. Because if you get a couple of rainfall events and you're late on a spray and it gets a fair big size about it, well, it's, you've got it right until the end of the season. It's nearly impossible to control. You have to start using pre-emergent herbicides in wheat, you need to use residual herbicides in fallows. Which is fine, and they work well, but you need rainfall to break the herbicide down to get out of that fallow and go through the next winter into the next summer or vice versa, and if that doesn't happen, you're in trouble. It's just something that, you can't rely on straight glyphosate, you can't rely on Group A herbicides, you've got to have a residual Group A glyphosate and gramoxone and double knocking and probably an optical weed spray machine like a WEED-IT or a WeedSeeker to manage it. And even with all those tools, it's very hard, and it's just, it's prolific with germinations. Yeah. It's terrible.

2. **BARNYARD GRASS.** Is difficult to control in some areas because ‘we don’t have a lot of chemistry registered to control them in fallow’. It also germinates with not much rain.

So barnyard grass is everywhere, and was relatively easy to control, so, you know, just the issue with barnyard grass was just the sheer numbers and it was on every farm. Now we've got glyphosate resistant barnyard grass that's made management a lot more complicated when you can't use glyphosate.

3. **RYE GRASS.** Concerns were expressed about glyphosate resistance in ryegrass.
4. **FLEABANE.** Is widespread across NSW and southern Queensland. Like Feathertop Rhodes grass, fleabane is naturally difficult to control with glyphosate and on top of that it is now also resistant to glyphosate. It is hard to control unless you control it very early. Some interviewees explained that fleabane is easier to control than other weeds because it can be controlled with residual herbicides and optical sprayers. Other interviewees explained that fleabane can be particularly difficult to control in cotton crops, that spreads easily, that it is difficult to control over the spring and summer, and that it is expensive to control.
5. **MILK THISTLE.** Milk thistle is widespread and has a growing number of weed populations that are resistant to herbicides. While it can be relatively easy to control when it is small, it is not easy to get when it is small. Some of the products that are coming onto the market that can be used to control milk thistle are quite expensive and need expensive equipment to apply it.
6. **SKELETON WEED.** Was first noticed in Western Australia (WA) in the 1960s and is now dotted across the wheat belt, with about 10,000 hectares of completely infested paddocks. It is a declared weed under the *Biosecurity and Agriculture Management Act* in WA. It is considered problematic because it is invasive, it uses a lot of moisture in summer, and because the chemicals required to kill it can also affect key agricultural properties, such as vineyards and horticulture.

Nineteen other weeds were mentioned by either one or two people as being in their top three weeds of most concern (Table 1).

Table 1. Common names of weeds of most concern to interviewees, which were mentioned by two (**bold**) or one interviewee.

barley grass	harrisia cactus	rubber vine
bedstraw	hudson pear	tiger pear
brome grass	kikuyu grass	tilia
buffel grass	needle grass	tropical soda apple
cape weed	parthenium	windmill grass
cottonbush	peach vine	
couch grass	(wild) radish	

In addition to the weeds mentioned above, interviewees identified a further 35 weeds that are of concern to them (Table 2).



Table 2. Additional weeds mentioned by interviewees that were not among the list of those of most concern. Weeds that were mentioned as new or emerging are in bold.

African boxthorn	Corn gromwell	(wild) prickly lettuce
African club moss	drooping cactus	prickly pear
African lovegrass	fireweed	saffron thistle
alligator weed	flowering poppy	serrated tussock
arum lily	Hudson cactus	scurvy weed
black oats	marshmallow	sow thistle
blackberry	mimosa	star of Bethlehem
bonestraw	Mexican poppy	thistle
caltrop	mother of millions	turnip weed
cape tulip	Paterson's curse	vetch
Chilean needle grass	phalaris	wild oats
Cocksfoot	pig weed	

The most significant weed management issues

There were 12 significant issues that interviewees believe affect the management of weeds. Herbicide resistance was the most frequently mentioned, being mentioned by 8/19 interviewees. The next most frequently mentioned was the cost of weed control (6 interviewees), the timing of chemical applications (5 interviewees), community engagement (5 interviewees), limited herbicide options (3 interviewees), spray drift (3 interviewees) and government funding (3 interviewees). The remaining issues were identified by one or two interviewees each.

- *Herbicide (glyphosate/Group A) resistance* – one interviewee explained (and others gave similar explanations) that there is an over-reliance on glyphosate because it is so cheap, which means that a greater number of weeds are becoming resistant to glyphosate. There are also few alternatives to glyphosate, which means growers are mixing more chemicals, applying chemicals at higher rates, and doing double knocks, which creates further herbicide problems down the track.

Well, you really don't have a lot of product selection, so the whole resistance thing is a huge concern, and that's probably, you know, there are more and more weeds that come in getting a high resistance to glyphosate. So, really, resistance, I think, is a huge problem.

Other concerns associated with herbicide resistance included: herbicide resistance is particularly concerning with respect to feasibility of controlling weeds in fallows, which has flow on effects for crop yields. Herbicide resistance also raises questions about how to manage tough-to-kill weeds in an economically and environmentally sustainable way.



- *Limited chemical options* – labels are not as broad as some interviewees would like them to be, e.g. no fallow label for some herbicides. There are also few new chemicals coming through, which means that there is not much choice in terms of modes of action. Some chemicals, such as glyphosate and 2,4-D, are being lost due to social licence issues.
- *Weed control costs* – including herbicide costs, cost of contractors, cost of employing someone to do the work. Most often, the costs of weed control were raised by interviewees when discussing the implications of managing herbicide resistance or changing other entrenched weed control practices.
- *Timing of chemical applications* – interviewees recognized that it is ideal to control weeds when they are small, but this can be a challenge due to the size of some properties and how long it takes to do weed control across the whole property. If it is not possible to spray the whole property in a timely fashion, information providers recommend focusing on outliers, focusing on boundaries and roadsides, and working back from there.

Probably timeliness. What we're asking growers to do is spray small weeds, potentially spray them more, have multiple passes out there. And a lot of our herbicides work so much better when the weeds are very young and fresh. And, you know, we've had a rainfall event, we've germinated some weeds. Particularly in summer when conditions get pretty hot, 40 degree days are pretty common. Everything works better when you're spraying small weeds that are nice and fresh.

Timing also relates to being able to apply desired chemicals when a grower wants to, but may not be able to because of other crops or fallows in the landscape.

- *Community engagement* – this included dealing with landholders, getting people to understand their biosecurity duty, making sure that people are aware that certain plants are weeds, and having that awareness before a weed becomes established on a property, and changing people's behavior because people tend to stick with weed control practices that they have been using for years.
- *Spray drift of 2,4-D* is particularly concerning in cotton growing regions. Spray drift issues constrain what products can be used, and also limit the number of hours that sprays can be applied. Such spray constraints can be a challenge due to the size of some properties or because of extended poor spray conditions, which means that weeds become more established while waiting for the right spray conditions.

So we're, from a drift management perspective, we're saying, you know, you really should only be operating for a few hours per day. And you're getting the pushback of saying but I've got 5,000 hectares to spray, I need to be spraying between four hours a day for a week and a half and you're telling me I can spray for three hours, you know, at one particular time in the day, how am I going to get across the country? So you've got that tension of operational efficiency versus spray drift and it depends on the conditions and the year as to how important that is.

Inversions are one key challenge associated with spraying at night. Attention also needs to be paid to the pH of water being sprayed.

- *Government funding* – concern was expressed about a withdrawal of extension and other support services, that government funding is insufficient to do compliance well and that there is insufficient continuity of funding.

I think continuity of funding is the biggest one. Irrespective of who's in government there needs to be continuity funding for weed control programmes going forward. And that's both federal and state governments need to if they're going there.



- *Time requirements* – interviewees focused on how long it takes to control weeds, and that a lot of growers are time poor. Herbicide resistance exacerbates this issue because it means growers need to spend more time planning and doing weed control.
- *Drought and changing weather patterns* – weeds and weed management change significantly depending on the weather, and droughts and wet summers both make this difficult to predict and control.
- *Weed control in fallows* – if it becomes difficult to control weeds in fallows it will have serious repercussions for cropping systems in some regions, as fallows are key to retaining soil moisture.
- *Pathways management* – preventing weeds from coming onto properties.
- *Roadsides* – a source of new weeds.

Area-wide management of weeds

There were diverse perspectives about what area-wide management of weeds is, the size of the area it could cover and the activities it could include. There was more consensus around which weeds would be best suited to an area-wide approach and a number of examples were provided of weed management programs that could be considered to be area-wide.

Overall, when interviewees were asked what the term “area-wide weed management” means to them, responses often included mention of a geographic area, who should participate and what sort of action is involved.

- **GEOGRAPHIC AREA** – the following terms were used to describe the area over which interviewees believed an “area-wide” approach would cover. Numbers in brackets indicate the number of interviewees who used the same term.
 - *Big picture* – “looking at a big picture rather than just an isolated incursion”
 - *Area* – “whole area” (2), “across an area”, “area level as opposed to an individual property level”, “multiple species over a large area”, “bloody big area”
 - *Region* - whole region based on climate zones or soil types, across the region, whole wheat-belt
 - *Catchment, sub-catchment or valley*, e.g. Gwydir Valley or zones within the Gwydir valley
 - *Landscape* - large areas of the landscape, “whole landscape”, “landscape”
 - *District* – “whole district”, “the district”, “local district level”
 - *Jurisdictions* – state-wide, several shires
 - *Nil tenure* (2) – every property on a certain road
 - *Property scale* – “within a management unit on a farm”



- WHO – “all”, “land managers”, “everyone” and “everybody” were the terms most commonly used to describe who should be involved in area-wide weed management. Other terms included “immediate neighbours”, “different organisations” and “key stakeholders”. One interviewee provided a comprehensive explanation of who should be involved in area-wide management by explaining that it involves “getting a group of people in a location that’s similar in its climate, soils and cropping kind of practice, and them working together”.
- WHAT - The following weed management activities were specifically mentioned by interviewees as potentially being part of area-wide weed management activities.
 - **Communication and education** of best practices
 - **Keep areas as weed-free as possible** - keep weeds under control, eradicate outliers, reduce weed loads and stop the spread of specific weeds
 - **Synchronise weed control activities**, e.g. coordinated herbicide application
 - Diversify weed management practices on **roadsides**, e.g. other herbicides beyond glyphosate or mechanical weed control
 - Establish social norms – change management
- WHEN – two interviewees mentioned the temporal dimension of area-wide management, through discussing the need for synchronous, coordinated timing of herbicide application
- WHICH WEEDS –interviewees were asked if there were any specific weeds that they thought would be well-suited to an area-wide weed management program. The following weeds were mentioned. Numbers in brackets indicate how many interviewees suggested each weed.
 - Feathertop Rhodes grass (6)
 - Fleabane (3)
 - Blackberry (2)
 - Windmill (or umbrella) grass (2)
 - Alligator weed (1)
 - Barnyard grass (1)
 - Boxthorn (1)
 - Chilean needle grass (1)
 - Harrisia cactus (1)
 - Milk (or sow) thistle (1)
 - Ryegrass (1)

Some interviewees mentioned classes of weeds, with particular characteristics, which they believe would make them more suitable for area-wide management. These included:

- Weeds that are spread by wind or a light-seeded (3)
- All grass weeds (2)



- Weeds susceptible to biological control (2)
- Weeds that spread from one farm to the next – weeds that are located across different properties (2)
- Widespread weeds (2) and weeds with a “good seedbank” – although one interviewee believed that widespread weeds would not be suitable
- New weeds in an area (1)
- Priority weeds (1)
- Weeds spread by water (1)
- Weeds spread by machines (1)
- Woody weeds (1)

BENEFITS

When interviewees were asked what they perceive to be the benefits of area-wide management, or what would encourage people to participate in an area-wide program, the following enabling factors and benefits were identified.

- Opportunity to learn from others about:
 - how widespread herbicide resistance is in an area
 - what management tools are available to manage herbicide resistance
 - the latest weed technologies and how to optimize their use

This gives people a head start on their weed management.

- Weed control will be more effective/rigorous
 - the costs will go down
 - there will be less seed movement across properties
 - difficult to control weeds will become less prevalent and become more manageable

Some participants explained that while they could see the potential for some benefits, they believed that area-wide management “wouldn’t help all that much” because they would still have a weed problem despite collaborative efforts.

COSTS

Many of the costs involved in area-wide management are similar to the costs that are often identified for weed management more generally. For example, a lack of money, labour and equipment were the most commonly mentioned challenges associated with area-wide weed management.

- MONEY – four interviewees mentioned the financial cost associated with undertaking weed control, including the cost of chemicals.
- LABOUR – two interviewees mentioned labour as one of the costs involved in area-wide weed management. This included the labour required to undertake the weed



control, and the labour involved in project management of collaborative efforts. There also needs to be consideration of the timing of area-wide weed management meetings and activities, to ensure that they are not in the middle of planting or harvest.

- **EQUIPMENT** – two interviewees mentioned equipment as a barrier to participation, such as people not having the necessary equipment, or the most efficient equipment to conduct area-wide weed management activities.

CHALLENGES

Beyond the costs and benefits of engaging in area-wide weed management, interviewees identified the following range of challenges that may undermine area-wide efforts.

- **DIVERSE WEED MANAGEMENT STRATEGIES** – five interviewees mentioned that a key challenge in establishing area-wide initiatives are the diverse values, capacity, levels of investment and commitment to weed management among land managers (both private and public). This includes concern that some land managers do not see weeds as an issue or preferring to manage weeds on their own.
- **STIGMA** – three interviewees mentioned that land managers are often reluctant to share their weed problems with others, because they don't want others to know that they have hard-to-kill or herbicide resistant weeds, or are concerned about bank managers finding out they have weeds because it may impact on the value of their property.
- **GAINING AND MAINTAINING TRUST** – three interviewees identified that trust is an issue in area-wide weed management. This involves ensuring that people know who their local weed professionals are and where they can get help. It requires building confidence that neighbours will participate in weed management activities, i.e. that there will be reciprocation and will overcome concerns about free riders. Building trust also requires demonstrating that there won't be any undesirable outcomes associated with participation and that there will be continued engagement from government.
- **NATURAL HAZARDS** – two interviewees expressed concern that the gains achieved through area-wide management could be easily undermined by extreme weather events, such as windstorms, floods, bushfires and droughts, which can bring seeds back onto "clean" properties.
- **DEMONSTRATING BENEFITS** – interviewees identified that it is challenging to show individual benefits of participating.

EXAMPLES OF AREA-WIDE MANAGEMENT

Interviewees identified the following list of past and existing programs that they consider to be examples of area-wide weed management.

- Biological weed control (3) – e.g. Hudson pear taskforce
- Cotton Catchups (2)



- Patterson curse project in Western Australia (2)
- Skeleton weed program in Western Australia (2)

I think it's quite successful because there's the local action groups, which are funded by our industry funding scheme, so by farmers. We, there are a few of us, and we're dotted over our wheat growing area, or our agricultural broadacre area, and we work individually but also under one program, so we kind of work as a team as well. We meet twice a year to talk about what we've experienced, how we can improve things, stuff like that.

- Sow thistle herbicide resistance testing (2)
- B&W Rural workshops (1)
- Bedstraw (1)
- Besom heath in Tasmania (1)
- Cotton bush (1)
- Parthenium weed (1)
- Serrated tussock program in Tasmania
- Weeds in stock feed (1)
- WeedSmart (1)

One interviewee provided the following rich description of the Hudson pear program. When asked what made the area-wide program successful, they clearly laid out the benefits of participation and how the program was organised.

The Hudson pear programme's probably the best example we've got at the moment. So that's been I guess the culmination of a couple of decades worth of research on biological control agents. And that's work that's been headed up by New South Wales DPI and with assistance with CSIRO.

At the local level we've got the Miners Associations around Lightning Ridge working with landholders. So we have a Hudson pear taskforce that meets out at Lightning Ride a couple of times a year. And that's made up of representatives from both government and agencies and communities and landholders. So that's been going on for a good decade or so now and we've been really looking at how do we weigh our strategies up for containing and controlling Hudson pear.

...

So number one, having a shared understanding of the problem at a local and district level. Having respect I think is critical. It's not a finger-pointing exercise or a blame game. These things have turned up. They're garden escapes. They've been out in the landscape for years and then bang, all of a sudden they've taken off. So pointing a finger and blaming people doesn't achieve anything.

It's really about identifying what's realistic. So we've actually got a business plan for Hudson pear. Some people wanted to completely eradicate it. We've looked at it. We've worked at and said, well, that's just not technically feasible being some of the core infestations.

But certainly outside, focussing on eradicating outliers, pushing it back into the containment zones, so within those containment zones we have people focussing on using chemical control on their property boundaries and their tracks and roads and those sorts of areas.



Beyond weeds, interviewees identified the following as area-wide programs that they were aware of or had participated in.

- Spray drift SOS program (7)

It wasn't targeting any particular industry. It was just all farmers, which is why I think it was successful, to really tackle drift, which was off target spraying, so just to try and promote better spraying practices to stop drift... so it was like a multi-industry approach to try and put out some good clear messaging around how we can minimise drift... there was also some mandatory changes to 2,4-D application at the same time, so you had to go to a very coarse nozzle and things like that. And we knew that it was successful because we asked the suppliers of those nozzles and things what percentage did they think had changed over, and it was 75 percent or something like that across the valley. We don't know whether it coincided with the drought, but we just had a lot less reported spray drift incidents. We just engaged with a wider audience than we normally would, and we did television ads and radio ads and things like that, that we hadn't done in the past.

- Pest insect management (3), such as silverleaf whitefly

So that was just getting together at various times throughout the season to discuss what insects were a pest and what your plans were on controlling them, so you could do a more targeted approach, and just letting neighbours know what's going on. There was probably about six or eight in each group, and we'd just meet two or three times a season just at someone's house.

- Wild dog control (3)

- Conical snail control in canola (1)

Concluding remarks

These preliminary findings reveal that there are a wide range of weeds that are of concern to land managers across Australia. The weeds that are perceived to be most problematic are those that display herbicide resistance, which makes them challenging and costly to control.

While participants had a broad understanding of what an area-wide weed management program might involve, there was little consensus about the scale of the region it could cover, and the types of activities it could involve. The money, labour and equipment required for a program to be successful was often the biggest concern. There were five key challenges—diverse weed management strategies, stigma, gaining and maintaining trust, natural hazards and demonstrating benefits—that would need to be addressed in the design of future area-wide weed management programs.

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