The Road to Eradication

…Prickly Acacia control without going broke

Desert Channels Queensland
2016

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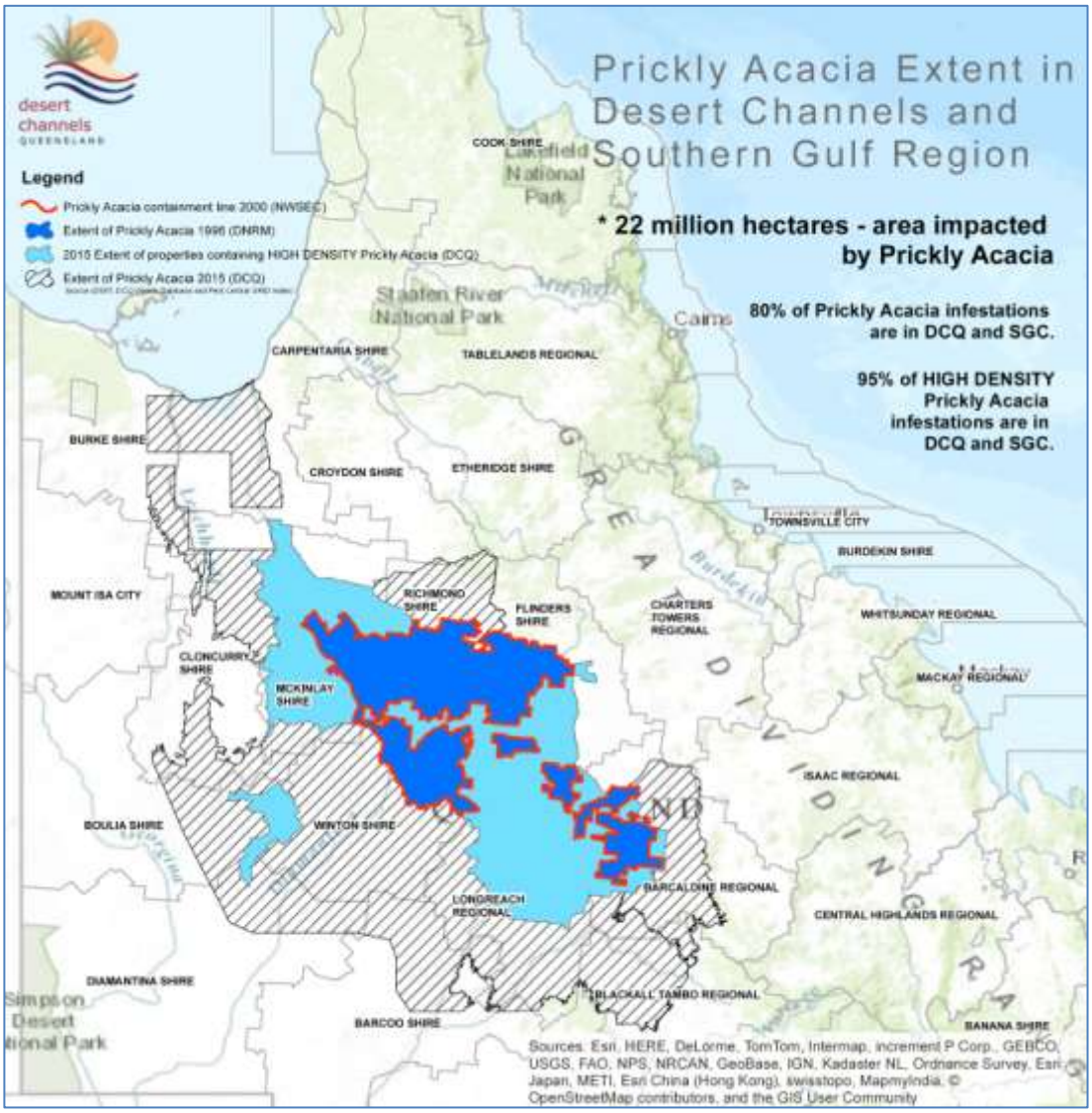
Background

In May 2013, 93 landholders attended a meeting at Sesbania, a property in the northern Lake Eyre Basin and within the core of the Prickly Acacia weed infestation. The meeting, coinciding with a Desert Channels Queensland (DCQ) field day outlining current and emerging weed control techniques for Prickly Acacia was designed to provide community direction for future DCQ programs to support landholder investment in weed control.

There had been a long history of control in the area, with numerous fact sheets and programs supported by national strategies and State initiatives. While the Queensland Government had, since 1996, reported that the area over which the weed was found remained static at 6 million hectares, anecdotal information suggested the infestation covered a much larger area. This assertion was supported by innovative foliar mapping of the weed first released by DISITI in 2013, along with field validated by DCQ, which suggested an area of infestation over 22 million hectares.



The meeting's purpose was to find solutions to declining landholder participation and co-investment in Prickly Acacia control, which was allowing an rapid expansion of the area affected by the weed and a marked increase in density of historic infestations. This increased impact of Prickly Acacia translated into reduced groundcover and, therefore, carry capacity. Figures from Mackey (1996), give pasture production loss from a 20% canopy of Prickly Acacia as 50%, while a canopy cover of 50% virtually prevents pasture growth.

The implications for landholders and the wider community from this tripling of the area impacted by Prickly Acacia in 20 years are driven by the consequent loss of groundcover:

- declining grazing enterprise productivity
- increased financial pressures
- increased susceptibility to drought
- increased safe refuge for feral animals (wild dogs, pigs, cats)
- gradual decline in the regional economy
- declining water quality – loss of soil stability and increased erosion
- declining biodiversity through loss of habitat
- increased pressure on threatened species (the ecosystems in the Mitchell Grass Bioregion home to 25 rare and threatened species including the Julia Creek Dunnart)
- decline in community assets (healthy waterways and landscapes)

It was quickly determined through discussions at the meeting that landholders had a good understanding of recommended control techniques for Prickly Acacia in paddock situations. However, they were increasingly reluctant to invest in its control while the major seed source areas, particularly watercourses, remained untreated.

Since the publication of information by the Queensland Government in 1996, it has been well understood that the two principle vectors for Prickly Acacia spread are water and stock. Therefore, effective control leading to eradication must deal with these two drivers in an integrated way.

Watercourses not only presented physical challenges, they also contained the highest density infestations, and are areas administered by multiple legislative instruments. Landholders saw control of Prickly Acacia in watercourses as prohibitively expensive and labor intensive. In addition, the recommended technique for these areas, basal bark spraying, was seen as ineffective in achieving long-term control – you kill the parent tree and 50 pop up to replace it.

Landholders were clear on two things: their re-engagement was dependent on a cost effective solution to Prickly Acacia control in watercourses; and their investment was dependent on multi-year support to deal with the seed longevity.

Aim

Through meetings like Sesbania, and consultations with the wider community in the development and updating of its Natural Resource Management Plan, DCQ determined that nothing less than a target of eradication of Prickly Acacia from the Lake Eyre Basin was required. The prospect of eradication, while seemingly implausible, was seen as vital in galvanizing despondent landholders and inspiring the required partners. Only an inspirational target, supported by successful achievement, would deliver the level of attitudinal and management change required.

The goal of eradication not only set the direction, it would be the yardstick against which control techniques were evaluated and integrated into farm management, how strategies and planning were directed, and how investment was prioritized.

Science and Mapping

This program has benefitted from multi-decade investment and work by Government, local government, landholders and industry. Work by dedicated individuals has sequentially added to the level of knowledge about this weed species.

Key scientific information was published by the Queensland Government in 1996, and re-validated in 2015/16 under the Queensland Government initiative, War on Western Weeds (WoWW). This work highlighted the necessity of controlling Prickly Acacia in watercourses and high water source areas to eradicate the major seed source areas and reduce further spread – national strategies have consistently highlighted the priority for control of these areas.

A second critical area of work, published in 2005, was undertaken by researches from the Department of Agriculture and the University of Queensland. There were two key findings from this work:

1. the effect of increasing densities of this weed on perennial grass production; and
2. the half-life of the seed from high seed producing areas was between 10 and 12 months.

This short half-life of seeds meant three things central to success:

1. ongoing control was critical in the initial three years after treatment to minimize the number of viable seeds remaining;
2. eradication must be viewed as a multiyear program; and
3. eradication was eminently achievable goal.

The release of DISITI foliar mapping of Prickly Acacia gave the first real regional picture of its distribution. By assessing density change over time it was also possible to prioritize not only region-wide zones for action, but also high priority areas at the local landscape and paddock level. By coupling this mapping with

detailed ground surveys of priority areas, DCQ was able to build accurate maps of weed infestation detailing location and density, both critical factors in determining the most appropriate, integrated solution.

DISITI mapping of the change in density and area of infestation has also pointed to the rapid increase in area of this weed since the 1990s. This is largely attributed to:

- the move from sheep to cattle[1] across much of the region;
- the reduction in on farm labour to undertake weed control; and
- the trend towards multi-property enterprises with movement of stock between the properties to minimize the effect of seasonal variability.

Based on 2013 mapping, it was estimated that Prickly Acacia was present across 23 million hectares of the 55 million hectares comprising the Mitchell Grass bioregion – a stark contrast to the 6 million hectares reported by Government since 1996.

In 2016 the Queensland Government updated its mapping and suggested infestations of Prickly Acacia now covered a potential 33 million hectares validating the DISTI mapping, the anecdotal information from landholders and cementing the need for a change in thinking about control of this weed.

Control Priorities

Based on the seed longevity work by researches from the University of Queensland in 2005, DCQ recognised that a sustained on farm control program of at least five years was required to break the re-infestation cycle. This research informs the following road to eradication:

- Year 1 – intensive control work of core infestations
- Year 2 – comprehensive control work on buffer zones; re-treatment of native vegetation protective zones[2]
- Year 3 – completion of buffer zones; re-treatment of native vegetation protective zones
- Year 4 – mopping up and monitoring
- Year 5 – mopping up and monitoring

[1] Sheep browse seedlings and prevent maturity; they also chew the seeds more thoroughly and pass fewer viable seeds. In contrast, cattle aren't active browsers, they pass a greater number of viable seeds, their dung pats are highly nutritious bed for germinating seeds, and cattle range more widely across the landscape.

[2] The mature native vegetation protection zone extends outwards to 30 metres from the drip line of the tree. Within this zone, only hand applied basal bark spraying is permitted; outside this zone residual herbicide, which kills germinating seeds for a minimum of three years, can be used. This means that inside the protection zone, mass germinations will occur each year until the seed bank is depleted.

Seed germination rates in years four and five would be insignificant and well within the capabilities of landholders. From then on it will be a matter of continued vigilance but declining effort to protect the investment.

Regional and on farm mapping, supported by science, has prioritized watercourses for control. Due to the range of physical challenges and weed densities at these sites, control activities are generally outside the labor and fiscal resources of the landholder.

Science from the Queensland Government indicates that mature trees in these high moisture environments can produce up to 175,000 seeds annually. Given that water is a prime method of seed dispersal downstream, and access to seeds from these trees by stock is a critical means of seed dispersal into the adjoining paddocks, the scale of the issue is evident.

In addition to the physical and fiscal challenges posed by these watercourse infestations, there are two legislative instruments that add a level of complexity to weed control activities that frustrates landholder aspirations.

Both the Vegetation Management Act and the Water Act administer these areas, and have a critical impact on weed control as they protect native vegetation and the integrity of the watercourse by excluding physical disturbance without approval and rehabilitation.

Physical control in watercourses, a preferred option for Government, was excluded early in the development phase due to its lack of support by legislative instruments, its impact on water quality and bank stability and its counter productive impact of providing the ideal disturbance conditions for mass germination events. The mass germination events undermine landholder confidence in control and, critically, work against the re-establishment of native plants in the area.

It was also recognised that landholders must work constructively together. Prickly Acacia control activities must not only meet the needs of the property owner, but must support and enhance control activities on adjoining properties.

Basal bark spraying, the most common control technique in watercourses, was prohibitively expensive at about $2.20 per tree. Given it is very common for Prickly Acacia densities in watercourse areas to exceed 1000 stems per hectare, control costs were far in excess of the capacity of landholders to fund and Government to subsidise. From a practical perspective, even with the most dedicated operator this technique with these densities can only control approximately 500 plants per day.

The challenge for DCQ was to find management techniques that:

- achieved weed control in the critical first three years;
- formed the center point of integrated management on the property by prioritizing watercourses, and leading to weed eradication;

- would be accepted by, and meet the aims of, Government legislation;
- provided the basis for rehabilitation of these sites;
- was cost-effective for landholders and would stimulate re-engagement with, and ongoing commitment to, Prickly Acacia control; and
- were efficient in Prickly Acacia eradication, allowing large areas to be controlled quickly to support regional priorities.

Innovation

CONTROL TECHNIQUES

Early advice from DNRM, the principle funding organization as well as the department administering both the Vegetation Management Act and the Water Act, identified two critical issues related to control techniques.

To be considered for regulatory approval for specific purposes under the legislation, proposed techniques must:

1. protect mature native vegetation; and
2. protect bank stability and provide for the conditions for rehabilitation of the watercourses.

Unusually for Government, this advice lacked direction towards prescriptive techniques and, therefore, opened the door to innovation to meet the aim of the legislation. Without this key step in the process the program would have been bound to the limited number of available approved techniques that have had little success and community uptake.

Supported by a range of Government, landholder and industry experts, DCQ undertook a desktop analysis of the benefits and costs of current and emerging techniques. As control in paddock environments was well understood, purely of private benefit and, necessarily fully funded by landholders, these areas were excluded from the cost benefit analysis. The DCQ program focused on Prickly Acacia control in watercourses with a community benefit and, therefore, could attract co-investment.

It quickly emerged that, to meet the Government aims of protecting mature native vegetation and preserving bank stability, and the DCQ aim of cost effective and efficient control options that exploited the short half life of the seeds, a composite chemical solution was needed.

Tebuthiuron, a residual chemical that gave a minimum three year control of seedlings, had been on the market for over a decade. It had a kill rate for Prickly Acacia of over 99% and cost $0.18 per plant, or one-twelfth of the then best practice basal bark method.

However, due to its indiscriminate effect, tebuthiuron is prohibited within 100 metres of a watercourse, and it cannot be used closer than 30 metres to the drip line of mature native trees - this meant that application accuracy was paramount. Given that hand application treatment of dense and ultra-dense infestations was out of the question, both from practical and workplace health and safety perspectives, aerial application was the only option.

An effective road block to this line of research was that trials in western Queensland with the aerial application of tebuthiuron from conventional aircraft, had found it impossible to apply with the required accuracy to protect native vegetation while simultaneously maximizing the cost-effective coverage of the associated Prickly Acacia infestation.

Not to be deterred, DCQ engaged with the federal regulatory bodies and found that an application to apply this chemical would be considered if it could meet application control standards along with tight planning, mapping and monitoring conditions.

DCQ turned to industry for a solution, focusing its attention on the emerging technology of unmanned aerial vehicles (UAVs), specifically the Yamaha Rmax, purpose built for agricultural application of chemicals. Over the course of four weeks on the property, Sesbania, PBE Services and Yamaha Australia developed flight patterning for the Rmax to meet the Australian Pesticides and Veterinary Medicines Authority (APVMA) application standards of +/- 1 metre accuracy, and collected the data required to support a permit application.

At the same time PBE Services developed all-terrain-vehicle (ATV)-mounted weed spreaders, with the first operational version supporting the program in late 2013. DCQ also worked closely with local weed control contractors to develop and perfect manual tebuthiuron application techniques applicable to both professional weed control teams and individual landholders.

Subsequent monitoring at the property, Auteuil, of work from a linked project confirmed that tebuthiuron applied by the PBE Services UAV had an effective kill rate of 99.96%. Despite an initial plant density at the monitoring site of 2300 stems per hectare, three years after the application of tebuthiuron by the UAV, germination rates were only 3 plants per hectare. Of equal importance, ground cover had increased from an initial 5% to 40%. These results have been replicated consistently throughout the treatment areas.

These kill rates, expected by DCQ based on data from the trials required to register tebuthiuron for this purpose, were repeated throughout the three years of the project. They have also been supported by results published in 2016 of work undertaken by QDAFF as part of the WoWW project.

DCQ delivered on its aim to provide effective control of Prickly Acacia in the critical first 3 years of treatment.

DCQ delivered on its aim to provide the conditions for rehabilitation of the Prickly Acacia control sites.

DCQ WEED PLANS

From the inception of this project, DCQ placed considerable emphasis on accurate data collection of Prickly Acacia distribution and density, and its subsequent mapping. A range of innovative data collection tools and techniques were developed to allow large western properties to be mapped cost effectively, and DCQ continues to invest in innovation in this area.

The importance of high quality data cannot be over emphasized; it informs everything that follows, not least the DCQ 5 Year Weed Plan for each property.

The DCQ 5 Year Weed Plan sets the foundation for eradication. It does this by:

- prioritizing landholder and DCQ investment in control and management activities over a five year period
- recording the range of management controls and actions to occur on the property as part of the combined commitment by DCQ and the landholder
- being the prerequisite for the activation of the AMP and APVMA[3] supporting legislative instruments.

Management options include changes in stock management routines to exclude stock from weed trees during seeding, integration of complementary herbivores such as camels, infrastructure solutions such as changing fence alignment and watering points, and sequential weed control activities.

An output from the plan is a detailed costing for both parties that can be used for forward budget planning. Experience over the three years of the program showed the accuracy of the data collection and mapping informed budget forecasts generally within 10% of actuals.

DCQ, through its 5 Year Weed Plans, has achieved its aim of integrated management on the property leading to Prickly Acacia eradication .

Innovative Legislation

APVMA

Data supplied to the Australian Pesticides and Veterinary Medicines Authority, led to the issuing of a permit allowing the application of tebuthiuron within ephemeral watercourses. The permit is tightly bound by conditions and can only be triggered by a DCQ 5 Year Weed Plan over the treatment area, ensuring Government confidence in the application of chemicals and monitoring of this permit.

[3] Both the AMP and APVMA are explained in detail in the Innovative Legislation section.

The issuing of this permit allowing the greater use of tebuthiuron, achieved a twelvefold reduction in chemical costs and an eightfold increase in efficiency. It remains the only permit allowing the use of this chemical in watercourses in Australia; the approval and maintenance of this permit is critical to this and future Prickly Acacia control activities.

Area Management Plan (AMP)

For the chemical costs savings potential of the APVMA permit to be realized, an innovative approach to Vegetation Management by the Queensland Government was required. This they delivered in the form of the Desert Channels Queensland Weeds of National Significance Area Management Plan[4]. Underpinned again by the DCQ 5 Year Weed Plan, this regulation is outcome based, not prescriptive of approved techniques. While requiring mature native vegetation to be protected, its focus on outcomes rather than techniques means it not only acts to support current innovation but allows for potential future innovation. It provides a balance between efficiency gains and protection of important elements of the landscape.

This legislative instrument is a critical enabler of the efficiency increase central to the success of this program. It allows activation of the APVMA permit as long as a DCQ 5 Year Weed Plan has been developed. This tiering of the regulatory instruments provides confidence to Government and ensures that desired outcomes are realized.

DCQ met its aim to provide a solution that would be accepted as meeting the aims of Government legislation.

Government Support

Political

This project would not have commenced without political support, and the support of the community. The Minister for Natural Resources and his department, numerous community members and Winton Shire Council, through the Mayor, were all early supporters of this program.

It is fair to say that this project represented a major departure from established thinking, was well outside the normal Government expectation of a program from an NRM group and, due to very challenging milestones, consistently had to continue to deliver control while simultaneously working on innovative solutions to emerging issues.

[4] AMP for the purposes of this document but, technically, the DCQ WoNS AMP.

Another departure from the established thinking is that this program requires co-investment by landholders – a major departure from the grant funding logic entrenched within Government. Co-investment was a requirement from the Minister of Natural Resources to ensure that landholders had 'skin in the game' and were committed for the entirety of this long-term project. The net effect was that landholders had a vested interest in maintaining controlled areas, but scarce Government funds were topped up by landholder investment.

The fact that landholders continued to invest in this program while grant projects administered by DCQ struggled to meet milestones, anecdotally supports the contention that 'matching funding' projects are a more efficient means of delivering on Government programs.

The milestones associated with this project were extremely challenging. This necessitated rapid maturing of onground delivery techniques, which presented significant operational challenges and demanded agile project management. Agile project management remains an essential component of successful delivery.

Government funding of this work through DCQ's NRM program, Northern Lake Eyre Basin Prickly Acacia Project – Stage One, required the delivery of onground projects and represented a robust real world test of this ambitious project.

Technical

Technical input from Government, industry and landholders from its inception have supported this program. The absence of this support would have meant that milestones could not have been achieved. Government has, and continues to support science into the control of this weed, which is invaluable. Industry continues to support the practical application of leanings from all parties and landholders continue to provide a ready source of information. From a government perspective, particular note should be made of the staff from the Charters Towers Tropical Weed Research Centre.

Funding

As mentioned above, DNRM funded a three-year project, Northern Lake Eyre Basin Prickly Acacia Project – Stage 1. This provided the major funding source to deliver the outcomes sought by community members. Landholders also co-invested over the three years by funding 50% of the chemicals. Funding by Government amounted to $1.065 million and investment by landholders in chemical amounted to $209,000 over the three years of the project.

In-kind support has also been provided by industry, in particular PBE Services and Yamaha Australia. PBE Services has continued to develop innovative solutions to complex onground problems and the application of UAV technology

to support onground delivery. This enhancement of the UAV technology has been supported by Yamaha Australia and has linked to projects at CSIRO and the University of Sydney.

Change Management

Community

This project was designed to change the community perception that Prickly Acacia could not be beaten, and worse, that we had to learn to live with this pernicious weed. Onground delivery, through Northern Lake Eyre Basin Prickly Acacia Project – Stage 1, began with the Lower Wokingham Landcare group, moved quickly up the Wokingham Creek, linked with work in the upper Thomson River catchment then moved sequentially down the Mills Creek. This work has been concentrated in the Priority weed zones 1, 2 and 3. These weed zones contain the strategically important Prickly Acacia infestations around the Ayrshire Hills, Sesbania and Woolfield.

It has, by ensuring that no property was left behind, effectively put two major drainage systems well on the road to recovery, and created a protective shield across the top of the catchment. The lack of missed properties (gaps in the shield) was a major contributor to the achievements of the project. No landholder has declined the offer to be involved – the result of a very successful extension program – in fact, more have wanted to participate than could be accommodated. Despite the most severe drought in a lifetime, landholder investment has continued and landholders continue to expand on the area of control.

Detailed DCQ 5 Year Weed Plans, cost-effective weed control, independent economic analysis presented at the Queensland Weed Symposium in Longreach, all contributed to demand by landholders for the project well exceeding the funding capacity.

Landholders involved in the project now view Prickly Acacia control as a normal part of daily property work, rather than an event to be scheduled. This change of attitude has been achieved through extension, training support and a sense of belief that comes from seeing large areas of this weed controlled. Landholders now have ATVs set up for the application of tebuthiuron on a daily basis and are rapidly expanding on the initial areas of control.

Efficiency gains and cost reductions have been achieved through three critical areas:

- The supporting legislation, particularly the APVMA permit has allowed the use of a chemical that reduces costs per tree by twelvefold. Consequently, this enables much larger areas to be treated for the same cost. The area management plan adds to this cost reduction by only requiring mature native vegetation to be protected. This means that costly liquid chemical applications are

further reduced. While difficult to estimate as clearly as the AVPMA permit, it is clear that the AMP represents a further, significant reduction in costs.

- The use of unmanned aerial vehicles on dense and ultra dense weed infestations (eight minutes and $16 per hectare) supports the application of chemical from ATVs in lighter infestations. Between the two, efficiency rates have doubled over the life of the project.
- Landholders re-engaging in weed control, when supported by the DCQ program, rapidly expand on the area controlled.

DCQ continues, both with government and industry, to pursue solutions to current issues. Work is underway to find solutions to expensive hand spraying around mature native vegetation. The control of weeds to protect just one mature native tree can be over $2800 in chemical alone. When coupled with workplace health and safety issues, the costs can escalate quickly.

Some of these solutions are likely to be a mix of integration of emerging technology and amendments to existing legislation.

DCQ has met the aim of providing cost-effective solutions for landholders to stimulate landholder re-engagement in Prickly Acacia control.

DCQ is meeting its aim of delivering efficient Prickly Acacia eradication allowing large areas to be controlled quickly to support regional priorities.

Government

While supported at the community and political level, this project has had a polarizing effect with Government agency staff.

It is clear that this project has challenged assumptions within departments about the level of control possible for this weed. Established thinking about control of Prickly Acacia has been challenged by combining innovative thinkers from a range of disciplines, with clear project aims. However, without the support of key staff in Government agencies, it is clear that this project would not have commenced. The project has clear supporters and clear detractors within Government agencies. Despite information provision and three years of extension directed towards Government staff attitudinal change has not been achieved.

Very competent and agile project management within DCQ, and advice from Government agency staff at critical stages, has guided the delivery of this project. It has also been aided by very competent technical support for field activities. Without this collaborative work the onground milestones would not have been achieved.

This project does not support the hypothesis that grants are an effective means of supporting practice change in community in natural resource management. However, it does support the greater role of effective extension to support onground delivery. Future programs seeking to influence catchment-wide land management should consider alternative delivery models as a means of achieving community practice change quickly. The project has also shown that landholders are willing to co-invest in activities, such as weed control, where they see cost-effective solutions and have confidence in the outcomes.

Outcomes

Output Monitored	**M&E Target**	**Completed under project**
Improved stream bank riparian vegetation	445 km	524.5 km
Improved terrestrial native vegetation	1,333 ha	10,187 ha
Integrated weed control measures	4,181 ha	4,381 ha
Improving the skills and knowledge	2 field days and 4 newsletters targeting 780 community members	1 field day complete with 1 due 15 Sept 2016 and 5 newsletters reaching 4,893 community members
Water quality testing	3 rounds over 3 sites	3 rounds over 3 sites

Output Monitored	**M&E Target**	**Completed under project**
Improved stream bank riparian vegetation	200 km	217 km
Terrestrial native vegetation with reduced weed threat	1,250,000 ha	1,138,000 ha
Integrated weed control measures implemented	450,000 ha	468,593 ha

Output Monitored	**M&E Target**	**Completed under project**
Weed control plans developed with land managers	24 plans	34 plans
Ongoing analysis of satellite images to determine prickly acacia foliar increase in partnership with DSITI	50.5 million hectares analysed	50.5 million hectares analysed
Media engagement	5 media opportunities	26 media opportunities
Website updates	Six-monthly	5 web site updates