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Managing old plant evaluation sites: containment and progressive eradication

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Abstract

During the fourth phase of a fifteen-year program across 69 locations in Queensland, four perennial legumes (*Acaciella angustissima* syn. *Acacia angustissima, Aeschynomene brasiliana, Aeschynomene paniculata* and *Indigofera schimperi*), rejected following evaluation as pasture plants, were managed to prevent impacts on the grazing industry should they become widely naturalised. Those unpalatable to livestock (*A. angustissima*, *A. paniculata* and *I. schimperi*) were targeted for control by killing plants before flowering. Plants were contained and seeding prevented at most locations containing <100 plants. By 2014 there were <10 plants at 71 percent, and <100 at 12 percent, of locations. Seeding occurred at some sites containing large populations. Control by landowners or the responsible agencies was encouraged, and participation was achieved at approximately half of sites by the end of the project. Collaboration between Queensland Department of Agriculture, Fisheries and Forestry (DAFF, formerly known as the Department of Primary Industries and Fisheries [DPI&F] and the Department of Employment, Economic Development and Innovation [DEEDI]) staff and (new) indigenous landowners proved an effective temporary approach for treating a large population of *A. paniculata* near Weipa. However, *A. paniculata* was found on three other properties on Cape York Peninsular, and surveying and treatment works undertaken. The decision to cease treatment of *A. brasiliana* appeared justified as vegetation studies confirmed grazing by livestock. Activities to support local control of the unpalatable species are recommended.

Abbreviations

AQIS	Australian Quarantine and Inspection Service
ATCFGRC	Australian Tropical Crops and Forages Genetic Resources Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DATSIMA	Department of Aboriginal and Torres Strait Islands and Multicultural Affairs
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
DNR&M	Department of Natural Resources and Mines
DPI&F	Department of Primary Industries and Fisheries
EPA	Environmental Protection Agency
MLA	Meat and Livestock Australia (previously the Meat Research Corporation)
NAPPEC	North Australian Pasture Plant Evaluation Committee
QPWS	Queensland Parks and Wildlife Service

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Executive summary

Project B.NBP.0706 is the fourth phase of a fifteen-year plant control program that began in 1999. The program was developed following concerns by government researchers and grazing industry representatives that some of the legumes evaluated in beef industry and state and federal government plant evaluation programs may become significant weeds of north Australian grasslands.

Potential impact of selected legumes as weeds
In the first phase of the program, four perennial legumes were considered potential contaminants of grasslands used for beef grazing. They were *Acaciella angustissima* syn. *Acacia angustissima, Aeschynomene brasiliana, Aeschynomene paniculata* and *Indigofera schimperi*. Climate-match analyses conducted by the project proponents found all are well-adapted to climates across large areas of northern Australia. All are prolific producers of long-lived (hardseed dormancy) seed and have either moderate (*A. brasiliana*) or low (the other three species) palatability to livestock. If not controlled, *Acaciella angustissima* grows into a tree and can develop into dense thickets, whereas the other three herbaceous legumes can form dense low-growing stands.

Reviews of perceived weed impact were conducted both within and externally to the program. *Acaciella angustissima* was listed as a 'Class 1 Declared Weed' in Queensland (along with other exotic *Acacia*) because of its perceived weed risk. Although having no formal weed status in Queensland, *A. paniculata* was recognised in an independent review as having a high potential to impact the beef industry (total of $350m) through lost production and plant eradication costs (Brinkley and Bomford, 2002; Cunningham *et al.*, 2003). The author of an MLA-commissioned review completed mid-way through the program found the four legumes differed in their potential to impact beef production if not controlled. Costs were estimated at: *A. paniculata* ($25m per annum to control plants) followed by *A. angustissiuma* ($6m) and *A. brasiliana* and *I. schimperi* ($1m each) (MLA, 2006).

Previous plant evaluation and eradication
Plant evaluation projects, undertaken between 1986 and 1998, included a wide range of species (over 2000 ecotypes) and land classes in Queensland. The projects enabled researchers to identify useful species and ecotypes, some being later commercially released, while identifying species or ecotypes with little potential future value. However, the projects involved the establishment, effectively biological release, of new plants at sites across Queensland on a variety of scales (small plots to 40ha grazing trials). In keeping with responsible practice, the proponents of the evaluation programs sought to undertake actions to prevent any undesirable plants becoming widely naturalised.

During the first phase of the eradication program, NAP3.225 (1999-2002), each of the 100+ evaluation sites planted to one or more of the target plants was surveyed and the data compiled in a database (Bishop, 2003). Plants of the four target legumes were killed prior to flowering using a range of techniques and plant populations monitored over successive visits. The overarching method was to: time visits to coincide with vegetative growth and when plants could be reliably detected; kill plants with selective herbicides, manual removal, cultivation or rotational cropping and use heavy grazing, fire and tree clearing to assist in these processes; survey surrounding areas and monitor plant populations. The plants were restricted to the eradication sites and mature (seeding) plants were removed from most sites. Plant populations were reduced by the end of the project.

During the second phase of the program, NBP.327 (2002-2005), project staff continued plant eradication activities at 66 locations (divided into 93 sites based on species present and management history), but also sought to increase awareness of the target plants amongst

stakeholders and promote best practice during pasture plant evaluation to minimise the risk of future release of undesirable plants (Cox, 2006). By June 2005, plant populations were believed to be contained at all locations and were significantly reduced at 70 percent of sites, mostly containing small populations of plants. Overall, 86 percent were considered to be under absolute control (i.e. all emerging plants killed before seeding). However, six locations, originally established on a large scale, contained large or mobile populations and it was impossible to kill all emerging plants and completely prevent seeding. Awareness was improved through a multi-agency forum attended by government, the Cooperative Research Centre (CRC) and industry stakeholders and a conference publication. The proponents also refined and promoted the use of a Code of Ethics for Pasture Plant Evaluation to promote future best practice.

The third phase of the project, B.NBP.0356 (2006-2010) saw increasing scrutiny on the relative weed potential of the four species and prioritisation of resources used to control them. Queensland Government weed risk assessments were completed and experimentation undertaken to better understand seed longevity and transfer. The team presented results at four weed conferences. Two separately funded surveying and treatment projects were also completed including all of the *A. angustissima* and *A. paniculata* sites in B.NBP.0356, plus those where plants had established, but were considered to have died out prior to 1999. Four new sites were identified including new populations of *A. angustissima* (Townsville, Charters Towers), *A. paniculata* (Mareeba) and *A. brasiliana* (Ayr). Over 8000 ha was surveyed at 'Batavia Downs' (Weipa) and patches of *A. paniculata* were found and mapped over ~3500ha.

Following completion of the weed risk assessments and accumulating evidence of higher palatability of *A. brasiliana* compared to the other species, priority of control was placed on *A. angustissima*, *A. paniculata* and *I. schimperi* (i.e. more frequent visits and treatments). This required additional project resources to treat the new large infestations and *A. paniculata* at 'Batavia Downs'. All legumes were still treated for control, however, and by 2010 86 percent of locations had 100 or fewer plants emerging annually and were considered under strict control and no plants were detected in the final two years in one third of sites. Sites with low populations included most of the *A. angustissima* and *I. schimperi* sites and over 80 percent of the sites containing *Aeschynomene* spp. Target plants were contained and seeding was prevented over the six years of the project at most of the sites.

Project B.NBP.0706 (2010-2014)
The fourth phase of the project saw increased emphasis on landholder participation in the control of the legumes, with a continued overall aim of containing plants to known control areas, preventing seeding and reducing plant populations. The highest priority for control was placed on *A. angustissima*, *A. paniculata* and *I. schimperi*, with project officers conducting the control, if required. Project officers supported landholders to manage *A. brasiliana* if required. Officers continued to visit all properties known to contain populations of the target plants in recent years, but there was increased emphasis on discussing control activities during on-site visits and the developing of local control plans. Information sheets were developed to assist information transfer.

There has been steady progress towards landholder control of *A. angustissima*, *A. paniculata* and *I. schimperi* over the last three years. Some sites are completely under landholder control and landholders are contributing to the control program at approximately half of the overall sites. Excellent collaboration with landholders, Regional Council and Queensland Government staff enabled the renovation of a large, mature population of *A. angustissma* near Townsville, enabled a more efficient control program. Control of plants by project officers has been required at many sites to contain plants to known areas and prevent further accumulation of seed in soil. Containment of plants in known control areas has been achieved at all but a few sites and seeding prevented at most sites containing

fewer than 100 plants. However, difficulty in detecting and treating all plants in larger populations meant additional seed has accumulated in soil at some sites.

Containment of *Aeschynomene paniculata* is of concern at a time when some properties on Cape York Peninsular, including 'Batavia Downs', are being transferred from Queensland Government to indigenous ownership. Through collaboration between the Department of Aboriginal and Torres Strait Islands and Multicultural Affairs (DATSIMA),formerly the Department of Energy, Resources and Mines, staff, local indigenous officers and DAFF project team members, there has been effective treatment of plants and surveying to detect outlier patches on 'Batavia Downs'. However, Queensland Government funding to employ indigenous officers for *A. paniculata* control is currently under review following completion of a three- year transfer of ownership agreement. In 2013 and 2014, *A. paniculata* was found by DATSIMA staff on two other properties being progressed into indigenous ownership. Collaborative arrangements similar to those used for 'Batavia Downs' were developed, and first year treatment of plants and surveying undertaken. Future effort will be required to detect and contain populations of *A. paniculata* on Cape York Peninsular.

Interviews and on-site discussions between project officers and landholders towards the end of the project indicate there is potential to increase landholder participation in the control of the three unpalatable legumes. However, most landholders requested some assistance by experienced project staff and a few would prefer all control be conducted by DAFF officers.

Vegetation surveys and inspections of sites confirmed *A. brasiliana* is well grazed by cattle when alternative pasture plants decline in feed value. Landowners were generally content to graze *A. brasiliana* areas, although some landowners (particularly new owners) are reserving judgement about the weed potential (or usefulness) of the plant to their operations.

Impact of the plants on the beef industry to date

The benefit of the control program can be interpreted as the potential cost prevented should the target plants become widely naturalised (i.e. the cost to control them and/or losses of production). Our experience suggests *A. paniculata* has the greatest potential of the four legumes to decrease the productivity of grazing lands. This is because it readily colonises grasslands and forms dense and persistent stands while being unpalatable to cattle and wildlife. By comparison, *A. angustissima* and *I. schimperi* are relatively immobile, forming dense stands and not readily colonising surrounding areas. *Aeschynomene brasiliana* is more palatable and therefore arguably of lesser impact.

To date, these plants are considered to have had a negligible impact on the beef industry because they have been restricted in distribution and have not caused measurable declines to the productivity of pastures. However, treatment of a few larger infestations of *A. angustissima* near Townsville and *A. paniculata* on Cape York Peninsular have imparted costs at a landholder level (albeit subsidised by the Queensland Government and through this project).

Impending changes to legislation in Queensland may result in changes to the legal obligations placed on landholders to manage weeds on their properties. It seems likely there will be a continued legal requirement to control *A. angustissima*, but landholder obligations to control the other three legumes (currently no requirement) are less certain and will require consideration when developing future control activities.

Recommendations

There is a continued need to treat populations containing the three unpalatable legumes to capitalise on good progress to date. A lower level of effort is required than in the past at most sites because plant populations have been reduced over the life of the program. However, significant effort is required to contain a few large stands of *A. angustissima* and

A. paniculata in north Queensland. Current management of *A. brasiliana* appears satisfactory, but populations should be monitored and the potential for this plant to impact negatively on enterprises reviewed over time.

The following actions are recommended:

For sites south of Cape York Peninsular

1. Continue to foster landholder control of the target plants, particularly *A. paniculata*, *A. angustissima* and *I. schimperi,* through site visits to assist with plant identification, the development of treatment options and (where required) the supply of herbicides (e.g. regular visits prior to seeding).
2. Monitor populations at sites containing *A. brasiliana* and discuss management with graziers (less frequent visits).
3. For all species develop a decision-making framework to assist landowners in determining critical cues for action and discuss their implementation with landowners.

For A. paniculata sites on Cape York Peninsular

4. Support local control efforts to contain *A. paniculata* through the provision of advice, developing site management plans, supplying or leasing equipment and herbicides, completing surveying and treating plants in the outlier areas.
5. Further promote awareness of *A. paniculata* on Cape York Peninsular to aid future detection and control.

The project provides excellent lessons and technical insight into the pre-emptive management of perennial legumes in extensive grassland situations. These should be incorporated into the development of principles and decision making guidelines for other species, which are evaluated in the future.

Contents

1 Background

1.1 Duty of care when evaluating new pasture plants

1.1.1 The benefits of using pasture plants in Queensland

Well-managed permanent sown pastures using introduced, mostly perennial, grasses and legumes are a productive, and now essential, component of coastal and sub-coastal beef grazing production systems in northern Australia (Walker *et al*., 1997; Walker and Weston, 1990). They enable graziers, across many soil types and environments, to cost-effectively achieve desirable stock growth rates and breeding performance, while reducing input costs from nitrogen fertilisers and feed supplements. 'Pasture-fed' beef also has market advantages over grain-raised cattle as consumers demand a high-grade, 'ethically produced' product (English *et al*., 2009).

Sown grasses and legumes sown into cleared land comprise the principal feedbase in coastal (higher rainfall) beef-growing enterprises. In lower rainfall areas where beef breeding tends to dominate, the benefit is due to improved ruminant nutrition through higher production of more digestible feed and extended seasonal production compared to many native pastures. Certain sown pastures help to conserve native grasslands through enabling higher production on certain land classes and therefore allowing strategic spelling of native pastures, minimising erosion and out-competing unpalatable weeds. Sown pastures have also been sown to repair grasslands degraded by over grazing (Chudleigh and Bramwell, 1996).

Sown permanent pastures contribute significantly to the Queensland beef industry. The annual gross benefit of beef production using pasture plants was estimated at $80m during the 1990s (Chudleigh and Bramwell, 1996) and an additional value of $2m per annum, reflecting new sowings of 'improved pastures', was estimated in a separate Queensland study (Robbins *et al*., 1996). The potential area in Queensland well suited to sown pastures was estimated at 22.1m ha (Walker and Weston, 1990) and by 1997 an estimated 4.9m ha had been sown (Walker *et al*., 1997).

1.1.2 Pasture plant evaluation for the Queensland beef industry

The primary purpose of the evaluation and release of new grasses and legumes was to increase or maintain productivity of the grazing industries, mostly through replacing or complementing native vegetation, considered to be less suited to the demands of profitable grazing systems. There was also a need to provide options to replace useful cultivars should they succumb to pests and diseases, as per other useful cultivars before them.

The development of sown pastures in Queensland was based on the targeted introduction of grasses and legumes from other tropical and sub-tropical regions. These were assessed in targeted environments and beef production systems across Queensland, then reviewed by a specialist panel comprising researchers and seed industry representatives, i.e. the Northern Pasture Plant Evaluation Committee (NAPPEC), and released as a 'cultivar' if deemed a useful type with low weed potential and commercial promise (Cox, 2013; Cox and Cook, 2003). Over 140 cultivars of grasses and legumes have been developed in Queensland, principally by State and Federal government agencies. Many are still being used successfully in sustainable grazing and crop/graze production systems. During this period a tropical pasture plant genebank (as seeds) was developed. The Australian Tropical Forages Genetic Resource Centre (ATFGRC) is maintained by federal and (later) state governments.

During the 1980s and 1990s, short-term plant evaluation programs were undertaken by DAFF and CSIRO, with funding from the Meat Research Corporation (now MLA). The three key projects were:

- Coordinated pasture evaluation in northern Australia (COPE) – Project DAQ.081 (1986-1995) (Pengelly and Staples, 1996)
- Backup legumes for stylos (BULS) – Project DAQ.083 (1992-1998) (Bishop and Hilder, 2003) and
- Legumes for Clay Soils (LCS) – Project DAQ.086 (1992-1996) (Clem and Jones, 1996).

These projects are discussed in detail in Appendix 9.1. In essence, the proponents sought to assess a wide range of (mostly) exotic grasses and legumes using small plots at sites strategically placed throughout Queensland. These plants were mostly wild plants from South America, Africa and India collected during the 1960s, 1970s and 1980s. A limited number of promising accessions were evaluated under controlled grazing and some of these were later recommended for commercial release following independent review.

These, and other, projects enabled researchers to identify the most promising species and accessions held within the ATCFGRC. In addition to identifying, and later releasing, promising accessions, the projects served to identify unsuitable plants, enabling reduction of the collection from 26 000 to 12 700 elite accessions (Cox *et al*., 2009).

1.1.3 Potential risks and concerns of the biological release of undesirable plants

Pasture plants for extensive beef systems must be productive (produce sufficient biomass of suitable forage quality), persistent under grazing, have good colonising ability and be readily (and affordably) established (Emmery, 1997). Some of these features can be considered characteristics of weeds and some pasture grasses and legumes have been shown to replace useful native vegetation and readily colonise undisturbed areas of high conservation value (Low, 1997). Plants with the above characteristics, but low palatability or acceptance to livestock, are generally considered to have weed potential. It is therefore implicit that considerable care be taken when evaluating new plant material for pasture development.

The weed risk of *new* plants today is assessed by the Australian Quarantine and Inspection Service as plants enter the country. However, at the time of the plant evaluation programs listed above, prevention of the release of a new weed from material in the forage collection relied on the research agencies and their collaborators. Care was taken to identify and prevent the release of weedy types before they were evaluated on a large scale. Although the plant evaluation projects were conducted conscientiously, it is now apparent that several legumes with weed potential were sown at larger sites in Queensland and some of these formed persistent populations of non-desirable species (Bishop, 2003).

The concerns of staff involved in the evaluation programs prompted the development of a proposal to assess the weed potential of some legumes established (effectively biologically released) at plant evaluation sites (Bishop, 2003). This led to a four-phase research and plant control program, the fourth of which is reported in this document. Final reports for each of these phases are available through MLA (Bishop, 2003; Cox, 2006; Cox 2010b) and the Executive Summaries of these reports can be found in Appendices 9.2, 9.3 and 9.4.

1.2 The target plants and formal weed status

The four target plants nominated at the start of the program were (Table 1):

- *Acacia angustissima* Willd. ex Vogel (now *Acaciella angustissima*);
- *Aeschynomene brasiliana* (Poir) DC;
- *Aeschynomene paniculata* Willd. ex Vogel; and
- *Indigofera schimperi* Jaub. and Spach.

Table 1. Origins and broad characteristics of the target species.

Acaciella angustissima syn. *Acacia angustissima*		
Common name(s):	Bolivian wattle, white ball acacia	
Family:	Mimosaceae	
Origin:	Southern North America, Mesoamerica and the Caribbean	
Habit:	Thornless shrub/small tree, 2-7 m high (most 3m). Prolific producer of long-lived seeds.	
Best environment:	Free-draining acid and alkaline soils, 300-3000 mm aar, 25-30ºC.	
Weed traits:	Forms dense mono-specific stands in vigorous grasses. Fire tolerant. Can coppice and grow from the roots ('sucker').	
Aeschynomene brasiliana		
Common name(s):	Brasilian jointvetch	
Family:	Fabaceae	
Origin:	Southern North America, Mesoamerica, northern South America and the Caribbean	
Habit:	Sprawling herbaceous plant to 2m (rarely above 1 m). Prolific producer of long-lived seeds.	
Best environment:	Free-draining sandy soils of neutral pH, 650-2200 mm aar, 24-27ºC.	
Weed traits:	Can form dense stands. Sticky pod segments. Tolerant of defoliation (dry season). Fire tolerant.	
Aeschynomene paniculata		
Common name(s):	Pannicle jointvetch	
Family:	Fabaceae	
Origin:	Southern North America, Mesoamerica and northern South America.	
Habit:	Erect stemmy plant to 2.5 m. Prolific producer of long-lived seeds.	
Best environment:	Poor and free-draining sandy and clay soils of acid/neutral pH, 900-3000 mm aar, 22-28ºC.	
Weed traits:	Dense stands. Detachable pod segments. Tolerant of defoliation (rare), fire.	
Indigofera schimperi		
Common name(s):	Indigofera	
Family:	Fabaceae	
Origin:	Eastern Africa and Asia	
Habit:	Perennial sub-shrub to 1.3 m. Prolific producer of long-lived seeds.	
Best environment:	Neutral to alkaline black clay soils, 250-1100 mm aar, 17-26ºC.	
Weed traits:	Persistent Co-exists with vigorous grasses once established. Can re-grow from the roots ('sucker').	

Information and images sourced from Cook *et al*., 2005 and Cox, 2009b.

Each of the four 'target' species were nominated for eradication because, during the plant evaluation programs, they were found to be persistent (perennial or recruited readily from seed), well adapted to many sites and produced large volumes of long-lived seed. *Acaciella angustissima*, *I schimperi* and *A. paniculata* were rarely eaten by stock. Accordingly, these were not released as cultivars. Whereas *A. brasiliana* was moderately palatable to stock, there were no weight gain data due to drought during field evaluation and potential varieties were removed from pre-release. Seed production of this species was also difficult due to sticky seed-pod segments.

After the onset of the control program, *A. angustissima* was included with other exotic woody *Acacia* spp. as a 'Class 1 Declared Weed' in Queensland and *A. paniculata* a national 'Sleeper Weed' (Brinkley and Bomford, 2002; Cunningham and Brown, 2006; Cunningham *et al*., 2003). Both classifications indicate significant economic or ecological impacts should the plants become widely naturalised and indicate high priority for control. *Aeschynomene brasiliana* and *I. schimperi* had no formal weed status over the duration of the program.

1.3 Targeted plant eradication program: Phase 1 (1999-2002)

1.3.1 Project structure

Project NAP 3.225 'Managing Old (discontinued) Plant Evaluation Sites (MOPES)' (1999-2002) was led and resourced by DAFF and co-funded by MLA. There was on-ground support from staff of CSIRO and James Cook University (JCU) and liaison with senior staff from DNR&M and EPA (Bishop, 2003). The on-ground project staff were familiar with the plant evaluation programs and the sites used for plant evaluation.

The scope of the project was Queensland-wide, with sites located from Cape York Peninsular to the southern border, including coastal, sub-coastal and (in a few instances) inland pastoral districts. On-ground staff were based at Walkamin, Townsville, Mackay, Gympie, Toowoomba, Roma and Brisbane.

1.3.2 Progress towards objectives

The project had four key objectives, to:

- compile a register of forage plant evaluation sites established in Queensland since 1986 (when the first of the three plant evaluation programs began)
- develop and implement a management plan for discontinued evaluation sites
- monitor, contain and, if possible, eradicate plants with weed potential
- Record procedures and document results for development of a site management manual.

The QPastures database, an intra-Government repository of plant evaluation and performance data, was used to compile a list of evaluation sites originally planted to one, or more, of the target plants. Eighty-two sites were monitored for the target plants and, where present, control of plants was undertaken. Selective herbicides, many identified in herbicide screenings conducted during the evaluation programs, were the major control method, although cultivation and cropping, manual removal of plants and strategic grazing were also used to suppress flowering and kill plants before they set viable seed. Eradication activities were timed (with rainfall or normal growing season) so that plants were treated before seeding.

The duration of the initial eradication program was insufficient to ensure eradication of plants at sites where the target plants had persisted and seeded (approximately 60 sites). However, plants (as well as could be detected) were restricted to their sites and plant populations and soil seed reserves began to decline at most sites. It is likely that periods of low rainfall in the 1990s contributed to low levels of plant emergence at many sites in

non-monsoonal areas. Control was most successful at the small plot-scale sites: large plant populations remained at some of the larger (up to 40ha) grazing sites.

A site management manual was not prepared at the time because a more applicable protocol addressed the *Environmental Protection Act 1994,* and a Code of Practice for Pasture Plant Evaluation (Cox and Cook, 2003), was under development by NAPPEC. This committee has since been disbanded.

1.3.3 Key recommendations

The full recommendations of NAP 3.225 are listed in Appendix 9.5. The foremost recommendation was to continue plant eradication activities to build on the reduction in plant populations. It was recommended the program would benefit from the involvement of a wider range of agencies, perhaps eradication programs from other government agencies. The development of information packages to promote future best-practice in plant evaluation was also seen as a priority.

1.4 Targeted plant eradication program: Phase 2 (2003-2006)

1.4.1 Project structure

Phase 2 of the eradication program continued immediately from Phase 1 (Cox, 2006). The proponents, on-ground staff and funding arrangements were similar to Phase I, although the role of Project Leader was transferred from Harry Bishop to Kendrick Cox (both DAFF). Staff from EPA and DNR&M continued their involvement in the strategic direction of the project.

Plant eradication activities continued throughout the three years of the project and were undertaken as conditions at each of the sites allowed. Activities to promote awareness of the project and best practice protocols for pasture plant evaluation were undertaken during final two years. The development of extension resources was a major component of the final year.

The project was reviewed by MLA during the final six months of 2005 and it was recommended an application be submitted for continuation (Phase 3).

1.4.2 Progress towards objectives

The project objectives (abridged) were to:

- eradicate plants at 80 percent of evaluation sites and reduce plants and soil seed loads significantly at the remainder of the sites
- develop action plans at sites where plants are not eradicated to ensure eradication is achieved
- produce technical information packages in a range of formats suitable for use by other stakeholders
- create awareness of the target plants and their control measures in a broad network of land protection agencies
- Document plant evaluation and commercial best practice.

Plant monitoring and eradication was undertaken at 66 locations divided into 93 sites. Large or well-spread populations were divided into up to five sites for ease of management and monitoring progress. The plant control methods were similar to the previous phase of the program, and control relied heavily on the use of selective herbicides. Drought interfered with the erosion of soil-seed banks in southern and central Queensland through preventing the conditions suitable for plant establishment. By June 2005, plant populations were believed to have been contained at all locations and were significantly reduced at 70 percent

of sites. One third of locations had no plants emerge for at least two years and 86 percent were considered to be under absolute control (i.e. all emerging plants killed before seeding). However, six locations, originally established on a large scale, contained large or mobile populations requiring a large proportion of project resources. Prevention of seeding was impossible at these sites.

A CD-ROM information resource was compiled, including information useful for locating, identifying and controlling the target plants. Weed threat was emphasised. This contained data and recommendations for all locations and acts as a central repository of information. A wide range of stakeholders (policy through to on-ground eradication and stakeholder industries) were exposed to, and contributed to, the eradication program through: a multi-agency forum; presentation at the 2005 Queensland Weed Symposium; and a community event (Weed Busters).

To document plant evaluation best practice, the NAPPEC Code of Practice was finalised and submitted to the custodian organisation (DAFF) of the ATFGRC for consideration as policy. The use of the Code of Practice was promoted at an international herbage seeds conference (Cox and Cook, 2003).

1.4.3 Key recommendations

Recommendations from NBP.327 are presented in Appendix 9.6. The key recommendation was to continue monitoring and treatment at all sites in order to contain the four target plants to current areas and reduce populations. Additional monitoring activity was required for the larger populations, notably *A. paniculata* at Batavia Downs. Continued development and adoption of the information package and the Code of Practice were also recommended.

1.5 Targeted plant eradication program: Phase 3 (2006-2010)

1.5.1 Project structure

The third phase of the eradication program saw continued emphasis on monitoring and control at all sites, improving awareness of the plants amongst landholders and other stakeholders and promoting measures to prevent future accidental releases of weeds when undertaking plant evaluation programs. It was recognised there was a need to improve delimitation in order to mitigate impacts of the legumes (Panetta and Lawes, 2005) and there a need to prioritise activity between sites based on weed status and population size.

The project team and collaborators were similar to those of the previous phase, although the impending retirement of Queensland Government and CSIRO on-ground officers and low likelihood of their replacement highlighted the need to encourage control by landholders where possible.

1.5.2 Progress towards objectives

The project objectives (abridged) were to:

- prevent seeding at all sites, with seeding prevented at sites containing smaller plant populations over the course of the project (80 percent of sites)
- have no plants detected beyond the control area of all sites
- Have no plants detected for the previous two years at 70 percent of sites.

The objectives were strongly based on on-ground monitoring and eradication using practices similar to the previous phases of the program. The key outcome was to minimise the risk of four weedy perennial legumes invading, and decreasing the production potential and conservation values of, northern grazing lands.

There was an increased emphasis on long-term management of the target plants within this phase and review of their weed potential given that they had now been regularly observed for over six years. Queensland Government weed risk assessments were completed for all four species (Csurhes, 2009, 2010a, 2010b; Csurhes and Navie, 2009); with no changes to official weed classification. Low palatability of *A. angustissima, A. paniculata* and *I. schimperi* and persistence through long-lived seed inferred these species have the potential to become contaminants of pastures, whereas greater acceptance of *A. brasiliana* by livestock suggested less potential for economic impact.

Improved delimitation of target plant populations was achieved through the completion of two surveying and mapping projects completed by DAFF staff with co-funding from the federal government 'Defeating the Weed Menace' program and Queensland state government 'Blueprint for the Bush' program (Cox 2009a, 2010). Through these projects, the project team was able to more confidently define the distributions of *A. angustissima* and *A. paniculata*. A précis of these projects can be found in the Final Report of Phase 3 of the program (Cox, 2010b).

Plant control activities were completed as for the previous phases of the program. Plant populations continued to decline at sites containing small populations (most sites) and by the end of the project 86 percent of locations had 100 or fewer plants emerging annually and were considered under strict control. No plants were detected in the final two years at one-third of sites. These included most of the *A. angustissima* and *I. schimperi* sites and over 80% of the sites containing *Aeschynomene* spp. Eradication was considered a realistic mid-term objective at these sites.

Large populations of *Aeschynomene* spp. at some sites in north Queensland were, however, more difficult to treat. Control areas of *A. paniculata* near Weipa (3500 ha) and Mackay (50 ha) were expanded following detailed surveying. *Aeschynomene brasiliana* sites near Mount Garnet (600 and 70ha) and Ayr (30ha), previously used for evaluation on grazing, full paddock scale also had larger control areas by the end of 2010. Seeding was reduced at these sites, but not prevented. Accordingly, containment, rather than eradication, was considered more realistic at these sites.

Progress of the program was presented at the 2007 and 2009 Queensland Weed Symposia (Cox *et al.* 2007; Keating *et al*. 2009) and experiments completed on *A. angustissima* seed survival in soil and the survival of *A. angustissima* and *A. paniculata* through the ruminant gut. Both were presented at Australian weeds conferences (Gardiner *et al*., 2008, 2010).

Overall, good progress was considered to have been achieved. However, uncertainty over the future of the ATFGRC (now being transferred to the South Australian Research and Development Institute) and low levels of pasture plant evaluation activity effectively stalled the adoption of the Code of Practice for pasture plant evaluation, and it is yet to be adopted as Queensland Government policy.

1.5.3 Key recommendations

Recommendations from B.NBP.0356 are presented in Appendix 9.7. The key recommendation was to continue monitoring and treatment to capitalise on previous work (Appendix 9.8). In a shift from the previous phases, and in recognition of declining resources, prioritisation was considered best based on the weed risk assessments. This meant placing most priority on *A. angustissima* and *A. paniculata* with lesser priority on *I. schimperi* and the least on *A. brasiliana*. Activities which encourage a greater role of landholders in detecting and controlling plants on their properties, where feasible, were also recommended.

1.6 The current project: Phase 4 (2011-2014)

1.6.1 Project aims

Although the principal aim of program has not changed, that is to prevent, or minimise, negative impacts of rejected pasture legumes on the grazing industry in northern Australia, there has been a reprioritisation of the four species nominated at the start of the program. This followed greater project team experience with the plants, the completion of weed risk assessments, improved delimitation (so better understanding of the size and distribution of the infestations) and measured trends in target plant populations over the curse of the program. Accordingly, highest priority was placed on the least palatable species *A. angustissima, A. paniculata* and *I. schimperi*, with lesser priority on *A. brasiliana* which had been observed to be readily eaten during the dry season at a number of sites in seasonally dry north Queensland.

Another key aim was to increase landholder participation in the detection and treatment of the target plants, recognising that project team resources are limited and more timely detection and control of plants can be achieved at a local level.

1.6.2 Project structure

There was a short delay between the completion of Phase 3 and the official (contractual) beginning of Phase 4 of the program. On-ground control works were maintained during the interim period to minimise seeding, particularly in sites with smaller populations.

Project staff structure was slightly different to the previous phases. At the onset of the project, officers were based in Brisbane (DAFF and CSIRO), Gympie (ex-DAFF), Toowoomba (DAFF), Townsville (JCU) and Mareeba (DAFF). The best-resourced team, from Mareeba covered sites around Mackay for the first two years, but gained the support of a DAFF Beef Extension officer in the final year. Two of the officers were employed on a casual basis post-retirement. There was continued participation by Queensland Government weed policy staff to provide advice on the evolution of weed policy within Queensland and DAFF weed scientists provided useful assistance in the development of fact sheets (to ensure legal requirements were met).

There was considerable collaboration with technical and management staff of Cairns DATSIMA following the detection of new *A. paniculata* infestations on three properties on Cape York Peninsular being transitioned from freehold or Government ownership to traditional owners (with co-management for areas of high strategic conservation value). Collaboration included facilitating on-ground works and providing access to sites, surveying, mapping infestations and the development of pest management plans. Activities at these sites also saw the involvement of an indigenous ranger group (Olkola) to complete surveying of new areas and control of any plants found.

The prioritisation of activities based on species presented a better workload for project staff, particularly those based in Mareeba, than in previous phases of the project (when many weeks were spent treating *A. brasiliana*). However, staff workloads did not diminish over the project as much as planned (with the anticipated increase in control by landowners) at the onset of the project.

1.6.3 Report content

This Final Report includes progress towards achieving the project objectives defined in 2010. The key focus is on the fourth phase of the project, but progress towards containing and reducing target populations is presented within the context of the entire program. Accordingly, the formats used are similar to those of the Final Reports for Phases 2 and 3.

2 Project objectives

By 31 July 2014, the Research Organisation will have:

1. For the sites previously treated in B.NBP.0356 and containing *A. paniculata* (except Batavia Downs), *A. angustissima* and/or *I. schimperi*:
   (a) Prevented seeding at all sites less than 5ha in area and minimised seeding at larger sites
   (b) Contained any plants to within the control area of each site
   (c) Engaged landholders at each site to transfer decision-making and on-ground treatment of plants from project agency staff to the respective landholders
   (d) Supported landholder management of the target plants, including demonstration of control and the provision of materials and advice
   (e) Documented plant population changes, and the transitional and ongoing management arrangements, at each site.

2. At Batavia Downs:
   (a) Developed a long-term strategy for the containment of *A. paniculata* with the landholders, namely Queensland Parks and Wildlife Service (formerly the Department of Energy, Resources and Mines) and the Batavia Indigenous Corporation, and
   (b) Assisted with implementation of the plan and monitored its progress.

3. For sites containing *A. brasiliana*:
   (a) Informed the relevant landholders of the intent to cease control activities, the reasons for this, and, where landholders prefer to continue control efforts, helped to develop a strategy for containment and/or progressive eradication.

3 Methodology

3.1 Overall strategy

Works undertaken in the current phase of the program represented a shift from previous phases as the project team responded to the evolving needs of a long-term weed control program. Key factors which influenced the change in approach included:

- a large number of sites (69 locations) spread across Queensland, sometimes making it difficult to conduct visits for optimum times (Figure 1)
- the need to continue to visit a large number of sites where plants had emerged in recent years (too early to be considered 'clean'), despite reductions in plant populations over the course of the program (most sites)
- a small number of sites with large populations in remote areas requiring considerable on-ground works to control/kill plants and prevent seeding
- a reprioritising of the perceived economic impact of the weeds based on weed risk assessments completed in the previous phase of the program
- The amount of previous investment and perceived future needs for investment.

Unlike in previous phases of the project, priority was placed on the control of the unpalatable (very occasionally eaten) *A. angustissima*, *A. paniculata* and *I. schimperi*. This involved detection and control of the target plants to contain and reduce plant populations. Control before flowering was targeted to erode soil seed banks of dormant (water impermeable or 'hard') seeds. Although detection and control was initially conducted by project officers, the project team was to encourage and support landholder participation in detecting and controlling the target plants on their properties.

The monitoring and control of a large *A. paniculata* infestation at 'Batavia Downs' near Weipa was treated separately to the other sites because of the labour (months of a full-time-equivalent [FTE] position) required to monitor and control plants over 5000 plus ha. The approach at this site was to assist in the development of control protocols with stakeholders (Queensland Government and traditional owners) and to provide support (information and equipment) for locally undertaken works.

Aeschynomene brasiliana was not treated for control by project officers as it had proven readily eaten by livestock (and perhaps wildlife) and could arguably be considered a useful component of pasture systems for beef livestock. Also, transport of seed through grazing in large (1000 plus ha) paddocks at sites near Mount Surprise, Mount Garnet and Ayr, had resulted in large infestations (effectively naturalised), which had previously taken considerable resources (particularly officer time) away from monitoring and treating the less-palatable species. Instead, the *A. brasiliana* sites were to be monitored by project officers and management discussed with landholders.

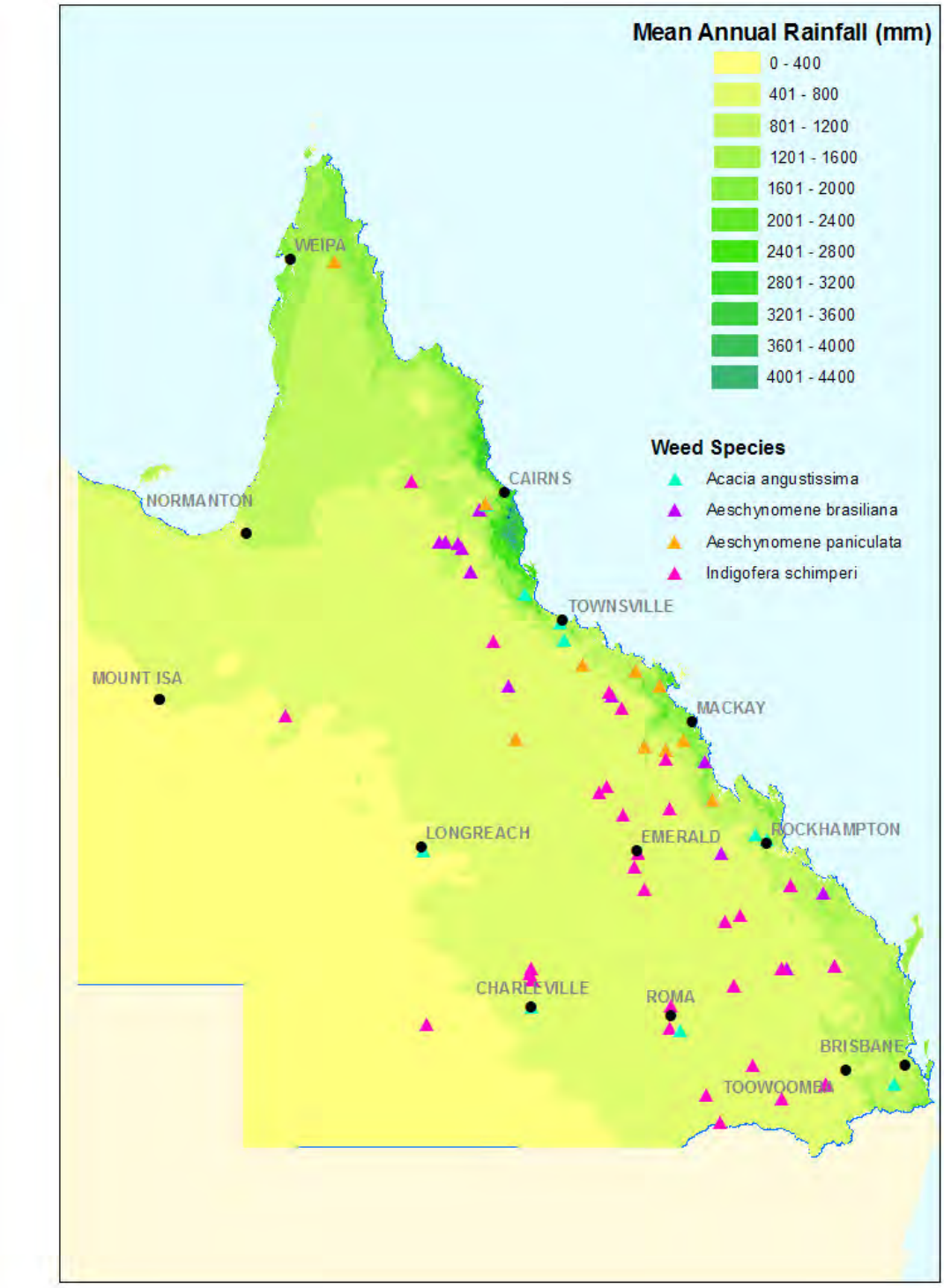


Figure 1. Distribution of core eradication locations treated in B.NBP.0706.

3.2 Containment and eradication of the unpalatable legumes

3.2.1 Strategy

The three least palatable legumes, *A. angustissima* (state-wide sites), *A. paniculata* (north of Mackay) and *I. schimperi* (mostly south of Rockhampton, with one each near Mackay and Chillago in north Queensland) were targeted for control and, where possible, eradication. Staff with good knowledge of the target plants and the plant eradication sites were to undertake or supervise weed control and monitoring in combination with site managers. It was recognised persistence and spread of all of the target species relied heavily on the production and movement of long-lived (hardseed dormancy) seeds. Accordingly, methods were used to kill plants before seeding to deplete soil seed-banks, and surveying was undertaken to detect plants moving from the known infestation areas.

Although detection of all plants and complete prevention of seeding was targeted at all sites, it was recognised that this was more realistic at small, well-defined and protected (fenced) sites where there were smaller emergent populations. These included most of the *I. schimperi* and *A. angustissima* sites. Prevention of seeding over the long term was also more common at these sites and they provided a greater prospect for future eradication. Such sites were given particular priority for project officer monitoring and treatment to reduce the risk of non-detection by landholders. Greater landholder activity was encouraged at the larger sites where control was beyond the capacity of the project team and it was easier for landholders to identify the target plants.

3.2.2 Choice of sites and timing of visits

The activity locations, usually a property, were divided up into one to five sites for each species present. This reflected differing management of the plants before or after the onset of control. For example, separate sowings during evaluation are usually referred to as separate sites while plants within defined areas are separated from escapees from these areas. Sites with larger populations tended to have a greater number of sites.

Locations where the target plants had been sown and established were mostly identified during the first phase of the program through records of the agencies involved in the plant evaluation programs. Those with persistent populations were considered ‘core’ activity sites (Figure 1). Additional sites were added to the program during the following phases, including this one (discussed below). A full list of sites included at the onset of the current phase of the program is presented in Table 2. This represents locations where one or more of the target plants were known to have established previously and so there is the possibility that plants could emerge from fallen seeds. It does not include 14 locations surveyed in Phase 3 of the project and found to have none of the target plants present (Cox, 2010b). B.NBP.0706 now includes 72 locations following the discovery of new *A. paniculata* populations on Cape York Peninsular.

Site visits targeted the treatment of plants between establishment and seeding and when plants were readily detectable. Visits were usually timed to coincide with good growing conditions, with moderate to high temperatures and prior rainfall the key criteria. Visits in monsoonal areas were timed to coincide with early season storms, which encouraged seedling emergence, and following the peak wet period to kill remaining plants before they seeded. Often an additional visit was undertaken during early winter to kill any plants previously missed. In areas with less reliable rainfall, visits were conducted when the officer considered it likely that the plants would have established.

Table 2. Sites included in B.NBP.0706.

Location	Latitude	Longitude	Species	Number of sites in B.NBP.0706[1]	Number of accessions sown	Site effort status 2005[2]
Batavia Downs RS	12.66	142.66	*A. brasiliana*	2	2	3
			A. paniculata	5	1	3
Wrotham Park	16.71	144.07	*I. schimperi*	1	3	1
Southedge RS	16.98	145.34	*A. paniculata*	1	1	NS
			A. angustissima	1	1	NS
Walkamin RS	17.13	145.42	*A. angustissima*	1	5	1
			A. brasiliana	1	3	2
			A. paniculata	1	1	2
Springmount	17.24	145.30	*A. brasiliana*	2	2	2
Burlington	17.82	144.36	*A. brasiliana*	4	2	3
Sugarbag	17.94	144.99	*A. brasiliana*	2	2	3
Lamonds Lagoon	18.37	145.14	*A. brasiliana*	2	1	2
Helen's Hill	18.78	146.13	*A. angustissima*	1	not sown	2
Campus Creek	19.32	146.75	*A. angustissima*	1	Unknown	2
Lansdown 1 CSIRO	19.66	146.83	*A. angustissima*	1	Unknown	2
Lansdown 2 RC	19.65	146.81	*A. angustissima*	NA	Unknown	NS
Bluff Downs	19.67	145.5	*I. schimperi*	1	1	1
Hillgrove	19.68	145.76	*A. angustissima*	1	Unknown	NS
Swans Lagoon	20.08	147.17	*A. paniculata*	1	Unknown	1
			A. brasiliana	1	Unknown	1
Mt Dangar	20.20	148.67	*A. brasiliana*	1	2	1
			A. paniculata	1	1	1
Goorganga	20.45	148.45	*A. brasiliana*	1	2	2
			A. paniculata	1	1	1
Braceborough	20.48	145.82	*A. brasiliana*	1	2	2
Birralee	20.65	147.68	*A. angustissima*	1	5	1
			A. brasiliana	1	2	1
Myuna	20.67	147.67	*I. schimperi*	1	1	1
Havilah	20.88	147.86	*I. schimperi*	1	1	1
Toorak RS	21.03	141.78	*A. angustissima*	1	Unknown	1
			I. schimperi	1	Unknown	1
Crediton	21.18	148.50	*A. brasiliana*	1	2	1
Tedlands	21.36	149.18	*A. brasiliana*	1	4	3
			A. paniculata	1	1	3
Glensfield	21.47	147.97	*A. brasiliana*	1	2	2
			A. paniculata	1	unknown	1
Strathdale	21.53	149.00	*A. paniculata*	1	unknown	2
			A. brasiliana	1	unknown	2
Lynford	21.75	148.67	*A. brasiliana*	1	2	2
			A. paniculata	1	1	1
Oxford Downs	21.82	148.67	*I. schimperi*	1	1	2
Carmilla Glen	21.96	149.5	*A. brasiliana*	1	2	1
Willunga	22.20	148.37	*I. schimperi*	1	4	1
Eungy	22.36	148.87	*A. brasiliana*	1	2	1
			A. paniculata	1	1	1
Carramah	22.87	147.90	*I. schimperi*	1	1	1
Rosebank	23.54	144.26	*A. angustissima*	1	4	1
Granite Vale	22.42	149.53	*A. brasiliana*	1	2	2
			A. paniculata	1	unknown	1
Mutation	22.48	147.48	*I. schimperi*	1	1	2

Location	Latitude	Longitude	Species	Number of sites in B.NBP.0706[1]	Number of accessions sown	Site effort status 2005[2]
Etna Creek	23.23	150.30	*A. angustissima*	1	4	1
Parkhurst	23.32	150.52	*A. angustissima*	1	unknown	2
Emerald RS	23.46	148.01	*I. schimperi*	1	4	2
Sorrell Hills	23.57	149.68	*A. brasiliana*	1	1	2
Raglan	23.75	150.75	*A. angustissima*	1	1	1
Goondooroo	23.82	148.12	*I. schimperi*	1	1	1
Galloway Plains	24.10	150.57	*A. brasiliana*	1	3	2
			I. schimperi	1	4	1
Birrong	24.23	148.30	*I. schimperi*	1	1	2
Wadeleigh	24.28	151.53	*A. brasiliana*	1	2	2
Kapalee	24.40	150.42	*I. schimperi*	1	1	1
Rangeview	24.70	150.10	*I. schimperi*	1	1	2
Brigalow RS	24.82	149.77	*I. schimperi*	1	4	2
Brian Pastures	25.40	151.40	*A. angustissima*	1	4	2
			A. brasiliana	1	4	2
			I. schimperi	1	4	2
Kiamanna	25.42	148.85	*I. schimperi*	1	1	1
Brumich	25.68	146.20	*I. schimperi*	2	5	1
Narayen RS	25.68	150.88	*A. brasiliana*	1	2	2
			I. schimperi	2	4	2
Glen Eden	25.77	146.22	*I. schimperi*	1	5	1
Valera Vale	25.88	146.27	*I. schimperi*	2	5	1
Kookaburra	25.92	149.78	*I. schimperi*	1	1	2
Belcrest	26.00	149.90	*I. schimperi*	1	4	2
Rolfe Park	26.38	148.77	*I. schimperi*	1	1	1
Norton	26.39	148.76	*I. schimperi*	1	2	1
Charleville lab.	26.41	146.24	*A. angustissima*	1	4	1
Holyrood	26.49	148.45	*I. schimperi*	1	5	2
Bindaroo (Roma)	26.67	149.03	*I. schimperi*	1	1	1
Sunset Downs	27.28	150.25	*I. schimperi*	1	3	2
Ellenvale	26.73	150.72	*I. schimperi*	1	1	1
Lyndon Caves	26.83	148.94	*A. angustissima*	1	1	2
Warrill View	27.50	152.40	*A. angustissima*	1	3	1
Glenbower	27.84	151.58	*I. schimperi*	2	4	2
Ula Ula	28.02	149.42	*I. schimperi*	1	2	1
Bringalily	28.09	151.17	*I. schimperi*	1	1	1
Kindon	28.09	150.78	*I. schimperi*	1	3	2
Boongargil	28.53	149.67	*I. schimperi*	1	3	2

[1] For reporting, each location is split up into a number of sites based on different management of areas.

[2] *Site effort status 2005*

1 Minimal effort: one visit per year by one officer to check for and kill occasional plants which may have established.

2 Moderate effort: two visits per year by one or two officers to kill plants before flowering and monitor the site

3 Major effort: three+ visits per year by three+ officers to kill plants before flowering and monitor the site. Equipment such as mobile spray rigs likely to be required.

The frequency of visits and the resources used were also determined by the perceived likelihood of seeding if no intervention was undertaken or the likelihood of missing plants in a particular visit. Accordingly, return visits were required at sites with larger plant populations; typically with thousands of plants emerging annually. One or two officers were required to: treat and monitor the smaller sites, with activities usually over half to one full day once; or twice per year depending on rainfall and level of local control effort when minimal resources were required. Larger sites required considerably more effort and equipment for detection (mapping in some cases) and treatment of plants: up to four weeks work for three or four staff per annum plus mobile spray units were required at the worst site.

3.2.3 Detection and treatment of plants

The method used to detect plants was dependant on site characteristics and the equipment available to the visiting officer(s). Surveys at sites with small populations were mostly completed on foot, whereas sites with larger populations in north Queensland were also surveyed using quad-bikes. Systematic monitoring methods were used, initially focussed around the core infestation area (located by GPS and field markers) and moving progressively outwards. Systematic approaches were particularly important for sites with larger populations (in north Queensland). At these sites, 'runs' were conducted between marked trees and spray dyes used to mark treated plants. GPS coordinates were also used to identify where plants had been found and treated in previous years. Nearby 'high risk' areas were identified and checked. These included gullies and creeks, cattle pads and camps and areas where vehicles may have transported seeds.

The methods used to kill plants at each site differed by target species, the size and nature of the plant population and the unique characteristics of each site (e.g. cleared or uncleared, cultivatable or not). The key methods used to control the target plants are presented in Table 3. Selective herbicides, applied as spot (knapsack or quad-bike) or boom application, were the most used method of killing plants because they could be applied efficiently and provided good control of plants. Areas treated with selected herbicides were often grazed or burnt to enhance detection of the target plants. Cultivation, sometimes in combination with selective herbicides as part of a cropping rotation (oats, sorghum etc.), was used when possible because it provided promise of excellent weed control. Small populations were often treated manually, with plants removed by hand or with a mattock, and seeds carefully removed from the site and later burnt.

Capital-intensive methods were used to treat two sites near Townsville which contained large populations of *A. angustissima*. This included commissioning a contractor to cutter-bar a ~2ha infestation before the land managers burnt the site and project staff provided follow-up herbicide spraying of seedlings using quad bikes. Helicopter spraying was used to treat *A. angustissima* plants at a nearby site.

3.3 Management of *A. paniculata* on Cape York Peninsular

3.3.1 Strategy

At the onset of the current phase of the program there was one large known infestation of *A. paniculata* on Cape York Peninsular. This was on 'Batavia Downs' station, west of Weipa, where a ~2ha site had originally been established. The core area (the plant site plus immediate surrounds) had been treated since the onset of the program. However, reports from the caretakers (for Queensland Government) of patches some kilometres away prompted an expansion of the control effort. The acquisition of quad bikes in the second phase of the program enabled more rigorous monitoring and treatment of plants and it soon became apparent *A. paniculata* had spread over a considerable area. A detailed surveying project was undertaken over the area surrounding the original treatment area during the third phase of the project (Cox, 2009) to better define the spread of *A. paniculata* and control

works were undertaken by the project team. Maps can be found in the Phase 3 report. (Cox, 2010b).

Towards the end of the third phase of the project, the Project Leader became aware that the ownership of 'Batavia Downs' was to transfer from the Queensland Government to traditional owners, with co-management of certain portions with high conservation status (national park and nature refuge). The development of strategies to continue control of *A. paniculata* on Batavia Downs during this transition was to become a key component of the current project.

3.3.2 Methods

The overriding method to continue control of *A. paniculata* was to contribute to the development of weed management plans to be included in the transfer agreement between the Queensland Government and the traditional owners and to seek funding for on-ground works as part of the transfer arrangements. Ideally, on-ground works were to be completed by locally sourced staff, with local supervision, in a timely manner, to control *A. paniculata* during and shortly after the wet season when road access to Batavia Downs is often difficult.

The project team also demonstrated plant and control methods to the local staff, completed additional surveying and treatment of plants in outlier areas and supplied equipment and herbicides for use by local officers. The project officers also sought to investigate any other reported incidences of *A. paniculata* on Cape York and undertake actions as required.

3.4 Management of *A. brasiliana*

3.4.1 Strategy

The decision was made to not seek routine control of *A. brasiliana* by project staff, but facilitate control where actively sought by the landowner. This followed observations of grazing of *A. brasiliana* by livestock in a range of environments over the course of the control program and prioritising the control of the three less palatable species. Indeed, grazing had previously been used to suppress the seeding of *A. brasiliana* at some sites. Instead, the *A. brasiliana* sites were visited and observations of plant populations and grazing recorded.

3.4.2 Methods

Aeschynomene brasiliana sites were visited by project staff and the following observations recorded: plant populations, companion vegetation and the level of grazing of *A. brasiliana* and companion pasture legumes. Visits were typically conducted during the dry season when grazing would most likely have occurred.

Vegetation surveys were conducted at three sites in north Queensland to quantify the level of grazing of *A. brasiliana*. These were conducted at sites near Mount Garnet ('Sugarbag' and 'Lamonds Lagoon') and Mount Surprise ('Burlington') at sites known to have previously contained large populations of *A. brasiliana*. The surveys were conducted during wet and dry seasons over two years at sites with either continuous wet and dry season grazing ('Burlington' and 'Lamonds Lagoon') or controlled grazing(40 ha weaner paddock) with limited wet season and heavy dry season grazing at 'Sugarbag'. GPS-marked surveys were completed over six or 12 100-200m runs (depending on the site) across areas which had previously contained dense patches and the frequency and level of grazing recorded at regular intervals (20 per run). Other measurements were recorded as for the other *A. brasiliana* sites.

Table 3. Methods used to control the target plants under various circumstances.

Acaciella angustissima	
Small populations (<100 plants)	*Small plants or seedlings:* Plants removed with a mattock, ensuring that as much of the root system was removed as possible. Selective herbicides, particularly Grazon[1] applied using spot-spray equipment (knapsack or quad-mounted spray tank). Cultivation and cropping. *Mature plants:* Selective herbicides, particularly Access[2] and diesel applied using basal bark spray or cut stump methods. If seeds were present, they were removed and burnt.
Large populations (100+ plants)	As for small populations. Graslan[5] pellets sometimes scattered by hand. Helicopter application of selective herbicides. Cutter-barring and burning residue at a few sites.
Aeschynomene paniculata	
Small populations (<100 plants)	*Small plants or seedlings:* Hand pulling individual plants. Selective herbicides, particularly Grazon[1] or Starane[3] + Brushoff[4] applied using spot-spray equipment (knapsack or quad-mounted spray tank). Occasionally Graslan[5] pellets scattered by hand after application. *Mature plants:* Selective herbicides as above or removal by hand (weak root system). If seeds were present, they were collected and burnt.
Large populations (1000+ plants)	Selective herbicides, particularly Grazon[1] or Starane[3] + Brushoff[4] applied using spot- or boom-spraying equipment. Grazing and fire used to enhance detection and emergence.
Indigofera schimperi	
Small populations (<100 plants)	*Small plants or seedlings:* Plants removed with a mattock, ensuring that as much of the root system was removed as possible. Selective herbicides, particularly Grazon[1] Starane[3] +Brushoff[4] applied using spot-spray equipment (knapsack or quad-mounted spray tank) or Graslan[5] pellets scattered by hand. Cultivation where possible. *Mature plants:* Plants removed with a mattock. Selective herbicides, particularly Access[2] and diesel, treating as for woody weeds. If seeds were present, they were removed and burnt. Graslan[5] scattered by hand at some sites. Cultivation where possible.
Large populations (1000+ plants)	Repeated cultivation and cropping where possible. Selective herbicides, particularly Grazon[1] and Starane[3] +Brushoff[4] applied using spot- or boom-spraying equipment. Graslan[5] scattered by hand at some sites. Cultivation where possible and the use of selective herbicides suitable for the crop sown (usually oats or sorghum).

1 triclopyr + picloram @ 300 mL product /100L water + non-ionic surfactant
2 triclopyr + picloram @ 1 product: 60 diesel
3 fluoroxypyr @ 750 m product/100 L water + non-ionic surfactant
4 metsulfuron @ 10-15g product/100 L water
5 tebuthiuron @ 1.5 g product/m^2

3.5 Activities to encourage awareness and control by non-project individuals or groups

3.5.1 Strategy

Long-term mitigation of any impacts of the target plants will benefit from a greater number of individual landholders and weed control agencies being aware of the plants, their significance and methods to control them (should it be required). The project team also recognises:

- It is possible some of the target plants are present in previously unknown locations or plants may spread from known locations.
- There is no guarantee that funding or physical or human resources would be available to undertake control into the future.

The approach taken has been to involve Queensland Government weed policy specialists and to engage land protection agencies (Regional Governments) where it is seen to be useful. Related activities included in previous phases of the program include the completion of Queensland Government weed risk assessments, talks at regional weeds forums and presentation of scientific papers at weeds symposia.

Landholders were considered to represent the most effective group to assist the project team to treat the target plants as the plants were (mostly) restricted to small areas on properties, meaning relatively little work was required per year to treat them and landholders were on hand to treat plants regularly or if required. However, this was contingent on landowners being motivated to control the plants, having the capacity to identify the plants before they had seeded and being familiar with weed control methods.

3.5.2 Activities undertaken within the current phase of the program

Project officers were actively engaging landholders at all sites to better involve them in monitoring and treating the target plants. This typically involved a phone call to organise a visit (and to seek permission to access the site) and the request of meeting on-site to identify plants and discuss control methods and strategies. Where the landholder was not available, the project officer would treat the site to ensure continued control of plants (particularly sites with small populations).

The following information was recorded at each visit:

- visiting date, number of officers and duration of visit
- plant populations: actual counts for small populations (say, < 100), estimates for larger populations
- seeding status of the target plants
- works undertaken by project officer to control plants
- interactions with landholders (meetings, demonstrations etc.)
- Other notes of interest: works undertaken by landholder, changes of ownerships, level of grazing, pasture condition etc.

Short reports for all visits (documents, emails) were sent to the Project Leader who then compiled the data in an Excel™ spreadsheet.

To provide aids for identifying and treating the plants, a fact sheet was produced for each of the four legumes drawing on the experience of project staff and the weed risk assessments completed in the previous phase of the program. The sheets were developed in collaboration with Queensland Government weed policy and scientific staff to ensure they were consistent with (changing) Government policy on weed classification and chemical registrations or permits.

The capacity and motivation for landholder control of the target plants was reviewed at a project meeting undertaken during 2014. Although control (or part control) of the target plants had been undertaken by landowners at many sites and future plans for control were known, this information was less clear for other sites. During a short extension to the project, it was decided to complete phone surveys to better understand the opportunity to transfer control to landowners and work collaboratively with them in the future to manage the target plants. A survey was developed and phone interviews were conducted during October 2014, to get a more objective view of landholder effort.

3.6 Within project reporting

Annual technical review meetings were completed at the end of each financial year. Officers provided reports of activities and progress towards controlling plants and flowering at their designated sites. Each officer was responsible for maintaining records of their eradication activities including the weed status of each site and any changes to the site which may impact on control of the target plants. Annual technical reports were prepared by the Project Leader using information from the staff reports and presentations and the project database and submitted to MLA for consideration. The information in this Final Report condenses the information presented in the last two annual technical reports and is compared to previous final reports to identify trends in plant population and control.

4 Results and discussion

4.1 The impact of growing conditions on weed control

The less palatable species, *A. angustissima, A. paniculata* and *I. schimperi,* targeted for control within this phase of the program were originally sown in differing, but overlapping, regions of Queensland (Figure 1). Most *I. schimperi* sites were in southern and central Queensland (mostly on heavy clay soils), whereas most of the *A. paniculata* sites were in coastal regions of north and central Queensland (mostly on sandy and loam soils). The *A. angustissima* sites covered the greatest geographical range with coastal sites between Cairns and Brisbane and sites as far inland as Longreach and Charleville (variety of soils). The more palatable *A. brasiliana* was originally established in similar areas to *A. paniculata* as it was assessed within the same evaluation studies (Bishop and Hilder, 2003).

Significant gradients in daily summer and winter temperatures and frost prevalence across the project area (Figure 2) can influence the establishment of seedlings provided there is sufficient soil moisture for seed germination. In general, summer temperatures were considered suitable for germination and establishment across the project area, whereas winter conditions were more conducive to plant establishment in northern and coastal areas than in southern and inland areas. Whereas heavy frosts can kill seedlings in frost-prone areas (some *A. angustissima* and many *I. schimperi* sites), established plants usually recover after defoliation (Cook *et al*., 2005).

Rainfall was the key determinate of the number of non-dormant (hardseed dormancy) and viable seeds germinating and establishing at a site and therefore the opportunity to erode the soil seed bank. Rainfall records for key centres are used here to illustrate the range of 'expected' (long term means) rainfall and the rainfall experienced during the project (Table 4). Months with rainfall considered sufficient for plant establishment were most frequent and consistent across years in the northern and coastal regions south to Mackay. These regions included most of the *A. paniculata* and *A. angustissima* sites, including the larger infestations. Annual rainfall often exceeded 1200mm and was, with the exception of a high rainfall event in July 2012, highest during summer months. This provided highly favourable conditions for rapid establishment of non-dormant and viable seeds in these regions. Reliable establishment of seedlings between years was observed at most sites in these regions, requiring regular checks to locate and control plants.

The inland regions in central and southern Queensland (represented in Table 4 by Emerald, Roma and Toowoomba) include most of the *I. schimperi* sites and a few of the *A. angustissima* sites. They typically experience lower and less reliable rainfall with a higher winter rainfall component than for the northern and coastal areas. Consistent with previous phases of the program, rainfall events sufficient for establishment were infrequent and unreliable. Useful rainfall events occurred mostly during summer/autumn with high rainfall events often associated with extreme weather events. Over the last three years, there was greater opportunity for establishment in southern Queensland than in central Queensland where there was little opportunity for establishment during 2013. Large rainfall events following prolonged dry periods often resulted in large populations of plants compared to previous visits to those sites. These provided excellent opportunities to erode soil seed banks, so timing of visits to detect and treat plants (before they seed) needed to coincide with these mass establishment events.

Observations of seedling numbers compared to previous management and rainfall indicated that fire and cultivation were useful tools for reducing hardseed dormancy in the three species targeted for control (*A. brasiliana* was generally in pasture which was not burnt or land which was not cultivated). Fire was deliberately used to promote seedling establishment of large populations of *A. paniculata* ('Batavia Downs' and 'Walkamin') and

A. angustissima ('Lansdown 2') before controlling seedlings with herbicides. Heat is known to overcome hardseed dormancy in a wide range of legumes (Argel and Paton, 1999), so it is not surprising that fire could reduce hardseed dormancy of seed-in-soil. Large seedling populations of *I. schimperi* at sites under regular cultivation ('Glenbower House' and 'Boogargil') also suggest a reduction in hardseed content or improved opportunity for 'soft' seed to germinate through exposure to conditions more conducive to establishment (transfer of seed to the surface).

Growth and plant development after establishment varied between species and growing environment. Most target plants established over summer months. The herbaceous plants (*A. brasiliana, A. paniculata* and *I. schimperi*) generally grew vigorously if provided adequate temperature and moisture and flowered and seeded in the first year, usually within three to six months of establishment. Greatest urgency was needed to treat these plants before seeding. The tree species *A. angustissima* took longer to reach reproductive maturity, sometimes not until the second year, resulting in a prolonged 'window' for control. Frost sometimes provided natural control of seeding in *I. schimperi* (southern Queensland) and *A. paniculata* (near Nebo), but did generally did not kill plants and these regrew when conditions became favourable.

All of the species regrew well after seasonal stresses associated with cold or dry conditions. Plant growth and flowering were observed to resume rapidly once favourable conditions resumed and these older plants often set seed well before new seedlings. For example, *A. paniculata* plants which established in January/February on Cape York Peninsular typically grew into small plants and flowered in the first season (by May). If missed, they resumed growth under storm rainfall in November/December and could flower by March as substantially larger plants.

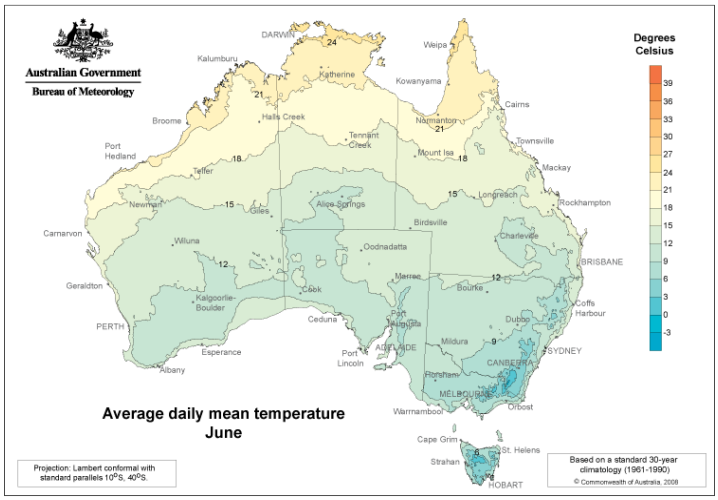
Growing conditions impacted considerably on the effectiveness of control methods. Treatment of plants using selective knock-down herbicides, the most common and efficient method for all but very small populations, was most effective when undertaken during active plant growth. This occurred under favourable growing conditions: warm with adequate soil moisture. Water stressed *A. paniculata* plants often dropped their leaves once water stressed resulting in poor uptake of herbicides and poor control of plants. This occurred in most years after flowering in areas north of Townsville. The more stress-tolerant *I. schimperi* and *A. angustissima* were less affected by moisture stress, although the efficacy of herbicides was also compromised by extremely dry conditions.

4.2 Plant containment and control

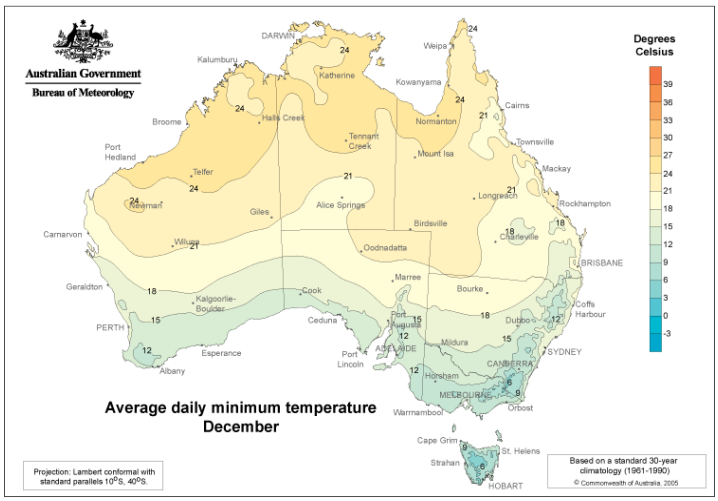
4.2.1 Number of sites included in the program

The full component of sites considered to have potentially contained viable seeding populations of the target legumes at the onset of the program was originally based on known sowings for plant evaluation programs. These are summarised by species in Table 5 (complete sowing lists can be found in the Final Report previous to this one [Cox, 2010a]). Most sites were sown well before the onset of the eradication program, so it was considered reasonable to expect a site to be 'clean' if no plants were found upon inspection early in the program. The list of sites included in the program was therefore reduced as they were checked and found to be clean, leaving the 'core' sites with populations where plants were known to have established and seeding likely to have occurred.

a. Mean June daily temperature



b. Mean December daily temperature



c. Mean frost days per year

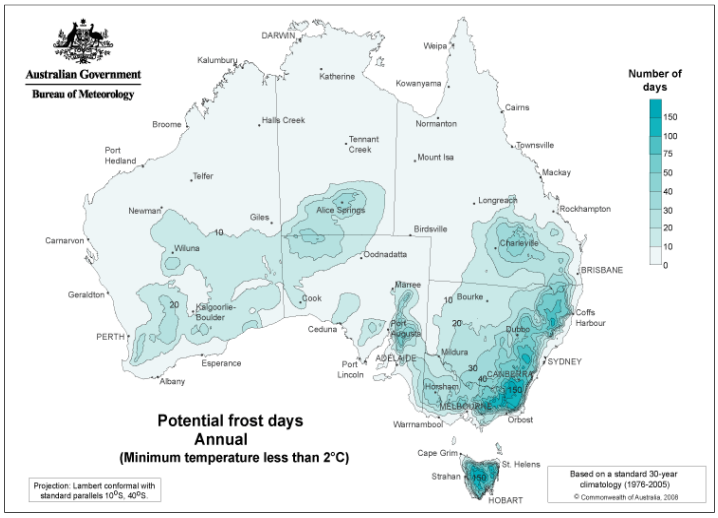


Figure 2. Broad temperature and frost characteristics across Australia. Source: www.bom.gov.au.

Table 4. Rainfall at locations representative of regions covered by B.NBP.0706. Periods when rainfall may limit[2] germination are filled brown and high rainfall[3] months blue.

Year	Total monthly rainfall (mm)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Weipa (station 027045)													
2011	696.6	464.8	296.4	328	8.6	1.2	0	1.0	0	10.0	96.6	362.8	**2266.0**
2012	444.2	491.6	720.6	36.6	1.2	0.8	9.2	0	0.2	27.6	82.4	82.2	**1896.6**
2013	909.8	127.2	442.8	48.8	7.0	0	0.2	7.8	0.2	8.4	210.4	59.2	**1821.8**
2014	505	932.6	396	65.8	3.6	12.0	0	0	0	-	-	-	**-**
L38[1]	463.0	563.6	396.7	94.8	20.5	4.0	1.3	6.7	1.7	25.0	110.9	289.7	
Townsville (station 032040)													
2011	178.6	334	696.2	88.0	23.4	15.8	1	0	0	15.8	18.4	180.2	**1551.4**
2012	266.2	248.6	556.2	16.6	69.6	28.0	105.6	1.4	0	0.2	7.8	14.4	**1314.6**
2013	286	83.6	104.6	48.8	29.0	1.2	4.0	0.2	0.6	8.8	139.0	9.4	**715.2**
2014	77.4	376.8	174.2	214.2	10.2	56.2	5.8	49.6	5.6	-	-	-	**-**
L71[1]	276.5	307.9	179.0	66.3	32.5	20.5	13.8	16.4	10.9	24.9	60.2	131.7	
Mackay (station 033045)													
2011	181.4	281.2	776.4	159	33.8	40.6	9.8	38.0	0.2	11.8	3.6	193.4	**1729.2**
2012	-	335.0	578.0	37.0	116.6	66.0	127.4	9.0	1.0	25.0	2.2	247.4	**1544+**
2013	325.0	-	386.8	310.8	90.8	15.0	16.2	1.2	4.6	19.0	88.8	17.2	**1275+**
2014	227.6	226.0	233.6	138.0	101.2	31.6	0.8	49.6	16.8	-	-	-	**-**
L121[1]	342.2	359.6	275.1	142.9	91.9	62.4	35.8	30.0	29.6	45.5	86.5	185.5	
Emerald (station 035264)													
2011	49.0	32.0	196.4	84.6	34.4	12.0	8.0	1.0	0	23.4	57.8	123.6	**622.2**
2012	132.2	93.8	166.6	36.4	52.2	45.0	49.6	5.2	5.0	31.0	25.6	40.6	**683.2**
2013	63.0	74.4	37.0	60.6	38.0	2.0	31.6	0	0.8	3.6	136.8	15.6	**463.4**
2014	49.0	61.6	82.8	5.4	6.6	9.6	0.4	25.8	79.8	-	-	-	**-**
L29[1]	87.9	81.5	42.8	30.7	18.4	31.8	12.0	25.4	32.1	41.0	56.1	91.2	
Roma (station 043091)													
2011	58.8	63.8	192.4	117	29.6	4.6	17.2	16.4	22.6	42.2	78.2	229.0	**871.8**
2012	165.6	155.8	50.8	10.2	29.4	51.4	29.0	10.4	8.0	28.6	24.6	50.8	**614.6**
2013	63.0	29.8	53.8	8.2	45.2	8.0	4.2	0	1.6	17.6	100.8	7.6	**339.8**
2014	14.2	73.8	103.8	3.4	14.2	24.2	4.2	58.2	14.0	-	-	-	**-**
L26[1]	69.1	89.3	48.2	35.5	36.7	29.5	24.2	24.3	26.3	56.3	63.1	78.2	
Toowoomba (station 041529)													
2011	413.0	108.4	120.4	42.8	69.6	11.0	13.4	66.6	22.4	89.0	74.4	125.8	**1156.8**
2012	98.2	106.0	86.8	33.2	14.8	103.0	28.2	7.2	27.6	59.4	45.4	57.2	**667.0**
2013	416	184.2	113.0	41.0	51.4	61.2	27.8	4.8	16.8	43.2	80.0	39.6	**1079.0**
2014	12.0	12.0	190.0	7.0	35.6	25.4	13.4	30.2	18.0	-	-	-	**-**
L16[1]	Records insufficient for long term means												

[1] Long term mean and years of data to 2010, L30 = 30 years data.
[2] Arbitrarily classed as months with less than 40 mm rainfall and following a month with less than 100 mm
[3] Arbitrarily classed as months with greater than 100 mm rainfall.

Sixty-nine locations ('core' sites) were included at the start of the fourth phase of the program (Tables 2 and 6). These included sites which either had populations present at the end of the third phase or previously contained plant populations known to have seeded prior to 2003. Three new *A. paniculata* sites were discovered on Cape York Peninsular over the last three years and works were undertaken to delimit and contain/control the infestations. The sites were located in the property adjacent to 'Batavia Downs' ('Sudleigh') and on two grazing properties ('Strathmay' and 'Mary Valley') near to 'Musgrave' and approximately 200 km south of 'Batavia Downs'. The discovery of these sites constitutes a significant escalation in the difficulty to contain *A. paniculata* on Cape York and the infestations and their management are discussed separately in Section 4.3 below.

4.2.2 Required eradication effort

As the plant evaluation sites were originally sown during the late 1970s, 1980s and early 1990s, there was potential for seeding for five to 23 years before the control program began (Table 5). The plant populations present at the onset of B.NBP.0706 were a result of the success and scale of the original sowing during plant evaluation, the amount of seeding before the onset of the eradication program (1999) and progress in controlling plants and seeding since then. The plant population status of each site at the onset of B NBP.0706 is presented in Appendix 9.9.

The chosen eradication strategy for each site depended on the growth and seeding characteristics of the particular species, the size and distribution of the population and any opportunities presented by characteristics or management of the site (e.g. the opportunity to use cultivation). Plant populations varied widely between sites. Most had only a few plants emerging annually (most *I. schimperi* and *A. angustissima*) and treatment times were typically short (a few hours). Others had tens of thousands of plants emerging annually over many hectares with treatment times measured in days or weeks of activity involving many individuals and organisations (Appendix 9.10).

The decision to not treat *A. brasiliana* for control meant that more effort could be focussed on containing and reducing the populations of the three less palatable species. This freed up officer time, particularly in northern Queensland where large *A. brasiliana* sites had previously been treated near Mount Garnet ('Sugarbag' and 'Lamonds Lagoon'), Mount Surprise ('Burlington') and Ayr ('Swans Lagoon' and 'Dalrymple Dogleg'). Considerable effort was required, however, to treat the following populations:

1. 'Batavia Downs' (Weipa) and three new occurrences on Cape York Peninsular. 'Batavia Downs' includes an extremely large and mobile population of *A. paniculata* over thousands of hectares. It appears seeds were spread from the original two ha plant site, presumably by vehicles and (to a minor degree) stock, between sowing in 1990 and the onset of the control program. The optimum time for treating plants was February to May, but difficult wet-season access meant that control was usually undertaken between late March and June. Local control was encouraged during the current phase of the program. Approximately one quarter of all project resources was used at this site.
2. 'Tedlands' (Mackay). This site contains a moderate-sized population of *A. paniculata*. restricted to a lagoon area (~50ha). Access and detection of plants is difficult in some areas, especially small 'islands' in the lagoon complex. The best time for treating plants is January to April in most years.
3. 'Lansdown 2' (Townsville). This site was detected relatively recently and included a large (1ha) dense infestation of *A. angustissima* plus escapees along a creek adjacent to the fenced paddock. Access to this site is excellent, but the density and maturity of the infestation meant extensive ground works were required to remove the original infestation and control masses of seedlings.

Table 5. Period of plant establishment during evaluation programs[1].

Species	Number of sites	Range of planting dates
Acaciella angustissima	30	1976-1990
Aeschynomene brasiliana	34	1975-1993
Aeschynomene paniculata	22	1982-1992
Indigofera schimperi	48	1975-1995

[1] Records sourced from the QPastures database. For a full list of sites and accessions planted, please refer to the previous Final Report (Cox, 2010b).

Table 6. Site and plant population characteristics and chosen control method(s) (excluding *Aeschynomene paniculata* at Batavia Downs).

	Target Species			
	Acaciella angustissima	***Aeschynomene brasiliana***	***Aeschynomene paniculata***	***Indigofera schimperi***
Number of locations[1]	17	24	11	38
Number of sites[1]	17	32	11	44
Plant population area (ha)	0.1–5.0	0.1-1000+	0.3-20	0.03–7
Control methods[2] **(number of sites)**				
Selective herbicide	10	3	6	22
Cultivation	0	0	0	8
Manual removal	5	1	4	9
Competitive grasses	0	0	0	3
Mechanical clearing	1	0	0	0
Strategic use of fire	1	2 (wild fire)	1	0
Grazing to suppress flowering	0	8	0	0
Plant population characteristics of sites containing plants at the onset of the project **(October 2010)**				
Few or occasional plants [value for 2005]	11 [8]	11 [10]	7 [7]	25 [22]
Scattered populations [[value for 2005]	3 [6]	15 [15]	6 [4]	13 [14]
Clumped/dense populations [value for 2005]	1 [3]	5 [4]	3 [1]	2 [2]
Woody vegetation **(2010) (number of sites)**				
Cleared woodland or open country (no trees)	14	19	6	44
Open or dense woodland	3	13	5	0

[1] Sites defined as a particular target plant population at a particular location. Often more than two species at one location, each with up to three sites per location.

[2] Often more than one method often used at one site.

4.2.3 The timing of visits and prioritisation

The timing of visits and typical work effort undertaken at all sites is presented in Appendix 9.10 (note this does not include 'Batavia Downs' or the other Cape York sites which are treated separately below). The southern and central sites, mostly containing small populations of *I. schimperi* or *A. angustissima*, were relatively easy to visit and treat in groups within regions because each site took little time to survey and treat and sites were often clustered. Local managers monitored and treated some sites with occasional visits from project staff to observe progress. The northern sites, however, were more widely distributed and often contained larger populations so specific trips were often undertaken to treat a lesser number of sites.

Visits to sites were prioritised by species and population. *Acacella angustissima*, *A. paniculata* and *I. schimperi* were visited first and most frequently as these species were targeted for control and therefore prevention of seeding was critical for long-term control. Sites with recent populations of the plants had priority over those where no plants had been detected for a number of years. In general, the frequency of visits increased with the size of the plant population.

Overall, the sites were visited as planned and in accordance with the aforementioned priorities. All *A. angustissima, A. paniculata* and *I. schimperi* sites known to contain plants at the onset of the project were regularly visited, plus most of those where no plants had previously been detected. In most instances, these visits enabled the treatment of plants before they set viable seed (or in time to collect seed before it was shed). Most of the sites not visited were those considered to be long-term 'clean': *A. paniculata* 'Goorganga' and 'Mount Dangar'; *I. schimperi* 'Bindaroo', 'Bringalily', 'Brumich' and 'Glen Eden', 'Ula Ula' and 'Valera Vale'. The 'Bluff Downs' site, where *I. schimperi* is poorly adapted and a few plants were previously found, was not visited at the recommendation of the owner. The *A. brasiliana* sites were visited less frequently, although most were visited over the course of the project as time allowed (See Section 4.4).

4.2.4 The choice and effectiveness of treatments

Sites with small or moderate populations

Many sites included small numbers of the target plants in defined areas within or immediately adjacent to, the original plant evaluation sites. A few of these are still within small fenced areas, but the fences have now been removed at many, so the plants are now within large grazed paddocks. Some are now included within crop areas, which are regularly cultivated. A few infestations (for example 'Helen's Hill' at a rest area on the Bruce Highway near Ingham) are isolated infestations of unknown history. Most of the sites are on private rural holdings (family farms) and a lesser number on Queensland Government properties, some of which are being transferred into private hands.

The methods used to treat plants at each site are individually specified in Appendix 9.25 and combined by site in Appendix 9.10. These are further summarised by species in Table 6. Selective knock-down herbicides were the most commonly used control treatment, particularly for larger plant populations. These were mostly applied as a foliar spray using hand-spray units for smaller populations or quad bike mounted units when treating larger populations. Terbuthiuron, a granular, selective residual herbicide was sometimes applied after spraying to kill mature plants and provide long-term control of seedlings. Terbuthiuron was only applied when there were no trees nearby to minimise the impact on native vegetation.

Overall, the herbicides and application techniques listed in Table 3 continued to provide satisfactory control over the target plants provided they were applied to actively growing plants. However, cut-stump techniques were required to treat larger (>1m) *A. angustissima*

plants which often survived foliar treatments. Mature *A. angustissima* and *I. schimperi* plants often survived herbicide treatments, regrowing from the roots or crown. These plants were treated using follow-up foliar spray applications or, if there were only a few plants, dug up with a mattock.

Small, often scattered, populations of *A. angustissima, A. paniculata* and *I. schimperi,* were controlled extremely effectively through manual removal of plants. The relatively small and fragile root system of *A. paniculata* plants meant they could be easily pulled from moist soil, although a chip-hoe was needed once soils were dry. The extensive tap root and root-suckering of *A. angustissima* and *I. schimperi* required the use of a mattock to remove as much root as possible.

Cultivation and control of emerging seedlings in arable crops (oats, sorghum) with selective cropping herbicides was highly successful for promoting germination and subsequently controlling *I. schimperi* (used at 26% of sites containing plants at the onset of the project). Large populations of seedlings were sometimes observed, e.g. 104 and 200 plants at Glenbower (House site) and 120 plants at Rangeview. Fire was found to be useful for encouraging mass germination of *A. paniculata* seed at Walkamin and *A. angustissima* at Lansdown 2. A hot (late season) fire was also found to kill mature *A. paniculata* plants at Walkamin and presumably destroy a proportion of seeds on plants.

Overall, the methods used are still considered to be highly effective at killing each of the target plants provided they are completed when plants are most susceptible to the particular treatment and a high proportion of plants are detected. Recommended control methods were included in information sheets developed during 2013/14 (see Section 4.5.3).

Sites with large populations
The sites included here include *A. paniculata* at 'Batavia Downs' (which is treated separately along with the new occurrences on Cape York Peninsular) and at 'Tedlands' (Mackay) and the large infestation of *A. angustissima* at 'Lansdown 2', near Townsville.

The Tedlands site includes patches of *A. paniculata* spread around tidal lagoons and pasture over some 20ha. The *A. paniculata* plants were treated conventionally, with visits undertaken between June and August each year to foliar spray plants with Grazon-DS™ (or similar generic triclpyr+picloram products) from quad bikes. Seeds were collected from plants when present, and older plants dug out with a chip-hoe if plants were considered too old for effective herbicide treatment. Initial works were undertaken by the Mareeba-based team, but a local officer was employed during 2013-14. The property manager was cooperative, but did not undertake control works. The methods were effective at killing plants and plant populations have continued to decline at this site and many areas within the site no longer contain plants. Seeding was considered to have been minimised, although it is recognised all plants cannot be detected in this complex site.

The 'Lansdown 2' *A. angustissima* population was only discovered in 2008 after following up on discussions with CSIRO researchers (nearby 'Lansdown 1' site). Works were initially undertaken in collaboration with the owners (Regional Council) to remove adult plants using a blade-plough and conduct follow-up control of emerging seedlings using selective herbicides. The initial control was highly effective, but poor follow-up spraying of seedlings by the Regional Council resulted in recovery of the stand.

A more rigorous effort has been undertaken since 2012, with involvement of the Regional Council, the leasee of the property (Wellards Pty. Ltd.) and Biosecurity Queensland. Meetings were held on site and a property management plan developed (Appendix 9.11) before works were undertaken to treat the infestation. A contractor was engaged to blade-plough the ~2ha site using an 'Elrot Plough', which removes extensive amounts of roots

(Appendix 9.12), and push the material into rows. Wellards staff then burnt the site and stick-raked and levelling infested areas, enabling follow-up treatment of seedlings by project staff using selective herbicides applied using quad bikes. The Townsville Regional Council contributed $500 to the ploughing of the site.

The collaborative approach taken at this site has, so far, been highly successful. All adult plants have been removed and massive populations of seedlings and young plants treated. Now that the site can be efficiently treated, it is anticipated soil seed levels will be significantly eroded over the next few years.

4.2.5 Progress towards eradication

Plant populations

Progress towards controlling the target plants was measured by estimating the populations of the target plants and controlling seeding over the project period, and comparing these data with plant populations at the onset (2005) and completion (2010) of the previous phase of the program. Estimates of plant population for each of the target species were recorded by officers for each visit (Appendix 9.25) and are summarised by site in Appendix 9.10. Officer expectations of plant populations over the next few years, based on control and trends in plant population, are presented in Appendix 9.13. The control of seeding and reductions in plant population are presented by species in Table 7 and plant populations at the end of the project in Table 8.

The short duration of the project (three years) made it difficult to identify clear trends in plant population change. However, emergent plant populations of *A. angustissima*, *A. paniculata* at *I. schimperi* have continued to decline over the last three years or remained similar to 2010 levels at most sites, indicating success in killing plants. This builds on progress from the previous two phases of the project and indicates soil seed levels are being eroded at most sites. Many sites now have fewer than ten plants emerging per year:

- *Acaciella angustissima*: no plants 53 percent,1-10 plants 29 percent
- *Aeschynomene paniculata*: no plants 45 percent; 1-10 plants 18.2 percent
- *Indigofera schimperi*: no plants 50 percent; 1-10 plants 18.2 percent.

Plant populations at sites with smaller populations tended to remain static as a few plants emerged each year from previously fallen seed. This is likely to continue for the next few years as viable seeds exit dormancy and germinate as conditions allow. There are indications that some of these sites are now (finally) moving towards joining the sites considered ‘clean’. These include *A. angustissima* at ‘Hillgrove’ and ‘Helens Hill’ and ‘Southedge RS’, *A. paniculata* at ‘Granite Vale’ and *I. schimperi* at ‘Belcrest’, ‘Glenbower’, ‘Holyrood’, ‘Kiamanna’, ‘Kindon’, ‘Myuna’, ‘Narayen’ and ‘Sunset Downs’. A few plants were found at some sites where none had been found in recent years (‘Norton’ and ‘Wrotham Park’), emphasising the need to occasionally check sites where plants have been detected in the last five years.

Trends in declining plant populations were also measured at some of the larger *A. angustissima* (‘Lansdown 1’) and *A. paniculata* sites (‘Tedlands’ and ‘Swans Lagoon’), indicating these sites are well contained and are moving towards more routine control. Good progress is also being observed at some larger *I. schimperi* sites (‘Oxford Downs’, ‘Valencia’ and ‘Brian Pastures’), but seeding events in recent years would have partially replenished soil seed banks.

Table 7. Factors contributing to the future weed effort of the four target species. Note: treatment of *Aeschynomene brasiliana* was not targeted in B.NBP.0706.

(a) Control of seeding

Species	***Level of seeding over 6 years***						
	No plants	No plants seeded	90% not seeded	60-90% not seeded	<60% not seeded	Regular seeding	Unknown
A. angustissima	5	9	1	0	1	0	1[2]
A. paniculata	4	5	6	1	0	0	1[2]
I. schimperi	8	18	2	4	3	0	6[2]
Total	**16**	**32**	**9**	**5**	**4**	**0**	**9**
(% of total sites)	**(21)**	**(43)**	**(12)**	**(7)**	**(5)**	**(0)**	**(12)**
A. brasiliana	11	1	-	-	-	12	5

(b) Population change

Species	***Estimated trend in population change over 3 years[1]***					
	New site	Little change	Declining, >50%	Declining <50%	Increasing, >50%	Increasing <50%
A. angustissima	0	12	0	3	1	1
A. paniculata	0	9	0	3	0	0
I. schimperi	0	22	5	11	1	5
A. brasiliana	0	16	7	1	1	2

1. Where officers believe they can make a reasonable estimate. Most of the sites omitted were those with very low plant populations or those considered clean.
2. Sites considered long-term clean, but not visited during the project.

Note: data do not include sites known to contain target plants at October 2010 and not visited during B.NPB0706.

Plant populations are considered to have increased at some sites containing the three species for which control was sought. The recently discovered population of *A. angustissima* at 'Lansdown 2' increased markedly as control activities (blade ploughing and burning) provided conditions conducive for seedling establishment once the mature infestation was removed. It is anticipated control of these seedlings with herbicide has enabled rapid depletion of soils seed reserves, although it is anticipated large populations will continue to emerge for many years. Other sites with increases in plant population include some *I. schimperi* sites under cultivation with large populations emerging after significant rainfall events ('Boongargil' and 'Glenbower').

Plant populations of *A. brasiliana* sites did not measurably increase at most sites over the duration of project despite the removal of control at most sites. However, monitoring was not as rigorous as for the three other species: visits were less frequent and less time was spent on monitoring as individual plants weren't being sought for treatment. Interestingly, plant populations declined at some sites containing smaller plant populations ('Wadeleigh' and 'Glensfield'), perhaps through suppression of seeding and eventual death of plants under regular grazing. A previously large population at 'Lamonds Lagoon' was reduced to zero plants (over two years) following an extremely hot (uncontrolled) fire during 2012. This may have been hot enough to kill plants and any seed on plants or in soil within a depth suitable for germination. *Aeschynomene brasiliana* populations are expected to have increased, however, at sites containing large, widely distributed populations in northern Queensland ('Burlington' and 'Sugarbag') as livestock transport seeds within large paddocks.

Table 8. Estimated plant populations at the end of the eradication program[1].

	Frequency of plant populations (2014)			
	Acacia angustissima	***Aeschynomene brasiliana***	***Aeschynomene paniculata***	***Indigofera schimperi***
Clean, none (%) [2]	9 [53.0]	13 [40.6]	5 [45.0]	22 [50.0]
[October 2010 %]	9 [53.0]	8 [25.0]	5 [31.3]	14 [35.9]
[June 2005 %]	[50.0]	[17.9]	[46.1]	[34.2]
1-10 plants (%)	5 [29.4]	1 [3.1]	2 [18.2]	8 [18.2]
[October 2010 %]	4 [23.5]	0	2 [12.5]	9 [23.1]
[June 2005 %]	[42.9]	[14.3]	[7.7]	[39.5]
10-100 (%)	2 [17.6]	7 [21.8]	1 [9.1]	7 [15.9]
[October 2010 %]	4 [23.5]	11 [34.3]	3 [18.6]	15 [38.5]
[June 2005 %]	[7.1]	[42.9]	[15.4]	[21.0]
100-1000 (%)	0	0	2 [18.2]	6 [9.1]
[October 2010 %]	0	7 [21.9]	3 [18.6]	1 [2.5]
[June 2005 %]	0	[14.3]	[7.7]	[5.3]
1-10 000 (%)	1 (seedlings)	4 [12.5]	1	0
[October 2010 %]	0	5 [15.6]	2 [12.5]	0
[June 2005 %]	0	[10.6]	[15.4]	0
>10 000 (%)	0	2 [6.3]	0	0
[October 2010 %]	0	1 [3.2]	1 [6.5]	0
[June 2005 %]	0	0	[7.7]	0
Not visited and containing plants by October, 2010	0	5	0	1
Number of sites[1]	17	32[2]	11	44

[1] Sites defined as a particular target plant population at a location. Often more than two species at one location, each with up to three sites per location. The data are based on site records and a review of site status at September 2014.

[2] Includes sites considered long-term clean, but not visited over the last three years

Containment of plant populations to sites

The capacity of each of the species to spread from the original plant evaluation sites (or points of first detection) is related to the mobility of the particular species, the ease of detection and treatment before seeding and the size of the plant population as this simply increases the number of propagules available for distribution. All of the target species produce large volumes of dormant seed providing a high capacity to spread (Csurhes 2009, 2010a, 2010b; Csurhes and Navie, 2009). However, differences in mobility have been observed over the 15 years of the control program. The *Aeschynomene* spp. have proven to be more mobile than *A. angustissima* or *I. schimperi*, the latter two tending to move very slowly from the areas where they were established, if at all. Observations over the past three years support the following:

- *Aeschynomene paniculata* produces pod segments which easily detach onto vehicles. Although seed production is not suppressed by grazing, the seed (if eaten) can germinate in dung and has been shown to survive a ruminant gut (Gardiner *et al.,* 2010). *Aeschynomene paniculata* also forms very dense stands, which present a large population of seed available for transport by vehicles or animals. Movement is slow if these vectors are not present.
- *Aeschynomene brasiliana* is more readily eaten by livestock, but generally only during the early dry season when viable seed is present. Observations of plants establishing in

dung indicate the seed survives the ruminant gut and germinates readily, so can be spread by stock. Heavy grazing can suppress seeding. Although there is no direct evidence, it is suspected that the sticky seeds, again in segments which easily detach from the parent plant, may stick to animal coats and aid plant dispersal.

- *Acaciella angustissima* - seeding is not suppressed by grazing, but the seed is not presented in a fashion where it can be easily transported by animals or vehicles. Instead it tends to form dense thickets. A longer period between establishment and the presentation of mature seed than for the other legumes also makes it easier to control seeding.
- *Indigofera schimperi* colonises grasslands steadily, slowly accumulating soil seed banks and spreading short distances by seed or washing down slopes under heavy rainfall. Although grazing does not generally suppress seeding, this plant has shown a relatively poor tendency to establish large populations, perhaps because it competed poorly with companion plants at many sites.

The project officers believe *A. angustissima*, *A. paniculata* and *I. indigofera* plants have been restricted to their known control areas over the last three years, particularly at sites containing smaller populations. Detection of plants can be difficult, however, particularly if there is dense companion vegetation or plants are very small when visits occurred, so there is a possibility some plants may have been missed.

There are three situations where plant distributions are known to have expanded, however:

1. The large infestation at 'Lansdown 2' where approximately 200 *A. angustissima* plants were detected and treated along a nearby, seasonally dry, creek (50-200m from the small fenced paddock containing core infestation).
2. The new *A. paniculata* detections on Cape York ('Sudleigh', 'Strathmay' and 'Mary Valley'. These are discussed further in Section 4.3.
3. 'Birrong' where *I. schimperi* has spread from the original plant evaluation site into neighbouring paddocks which are managed in a cell-grazing system. This site is under the control of motivated landholders who are actively seeking *I. schimperi* and controlling it with herbicides.

It should be noted that a few sites considered long-term clean were not visited during this phase of the project (these were included on a precautionary basis) as priority was placed on sites known to contain plants in recent years. There is a slight chance that long dormant seed has germinated at these sites and it is recommended these be visited in future to check for plants.

Although detailed surveys were not completed over the past three years, it is expected that *A. brasiliana* has spread from plant evaluation sites in large grazed paddocks as in the past. Spread is typically into areas frequented by cattle, including cattle pads, cattle camps and around water points and licks. Sites where this is likely to have occurred include 'Sugarbag' (Mount Garnet), 'Burlington' (Mount Surprise) and 'Swans Lagoon' (Ayr) where there were previously large populations. These sites are located in areas where *A. brasiliana* appears extremely well adapted, and where it is readily eaten by cattle.

There have been no other occurrences of the four legumes reported to project officers over the last three years.

Prevention of seeding

The prevention of seeding was a key objective of the project. Progress towards the prevention of seeding is presented for each site visit in Appendix 9.10 and summarised by species in Table 7. The summary includes the worst seeding event over the last three years. Using this conservative approach, it is estimated that seeding was prevented in 43 percent of sites which had plants emerge during the last three years, an improvement over

previous performance. When combined with sites with no plants emerging and plants considered long-term clean but not visited, seeding is estimated to have been prevented in 76 percent of sites. This is considered an excellent result, although the results should be treated with some caution as it is always possible a few plants were not detected and allowed to seed.

As for the previous phases of the program, seeding was most successfully prevented at sites containing small plant populations. This included all *A. angustissima, A. paniculata* and *I. schimperi* sites with populations less than 10 plants and most with populations between 10 and 100 plants. The removal and destruction of mature seed was necessary at many sites (all species), particularly during follow-up visits to check the efficacy of previous visits.

Seeding was most common at sites containing large populations of plants (>100), particularly where distributed widely over woodland. As a result, when seeding occurred, it tended to be at sites where seeding had occurred over the last five years. These include:

- *Acaciella angustissima* – 'Lansdown 1' (major seeding event) and 'Lansdown 2' (minor)
- *Aeschynomene paniculata* – 'Southedge RS'
- *Indigofera schimperi* – 'Brian Pastures RS', 'Emerald RS', 'Goondooroo', 'Kapalee', 'Mutation', 'Oxford Downs', Rangeview' and 'Valencia'.

A minor *I. schimperi* seeding event at 'Birrong' was unfortunate as seeding had previously been prevented since 2006. Seeding clearly occurred at the large 'Batavia Downs' *A. paniculata* sites and the new occurrences detected on Cape York Peninsular.

Soil seed banks are expected to have been reduced at most sites through killing plants prior to seeding. However, soil seed levels can take many years to deplete. For example, a new *I. schimperi* plant established in a grazed paddock at 'Holyrood' even though the responsible project officer was confident all plants were controlled before seeding for the previous 14 years. A long-term effort will be required to erode soil seed banks at sites with large populations and regular, if reduced, seeding. The immediate challenge for these sites is to contain and reduce plant populations and seeding as much as possible, until full seeding can be efficiently and routinely achieved.

Seeding of *A. brasiliana* was prevented by actively killing plants at only a small number of sites and then only sites with small populations. Although seeding was recorded to have occurred at most sites with moderate-to-large populations, seeding is expected to have been significantly reduced through grazing (most sites) or slashing (two sites).

4.3 Aeschynomene paniculata on Cape York Peninsular

4.3.1 Containment and control on and close to 'Batavia Downs'

Scope of containment and control activities

'Batavia Downs', located centrally within Cape York Peninsular east of Weipa, contains a large population of *A. paniculata* (Figure 3). Originally established in a two hectare area, *A. paniculata* is believed to have spread to adjacent areas before the onset of the control program. Vegetation surveys conducted during 2006 and 2007 were used to better define the extent of the infestation and develop work plans to contain and reduce *A. paniculata* on 'Batavia Downs' (Cox, 2009a). *Aeschynomene paniculata* is now known to be spread over some 5000 ha surrounding the original plant site, mostly in fenced paddocks using for cattle grazing and areas immediately surrounding these (Table 9 and Figure 3).

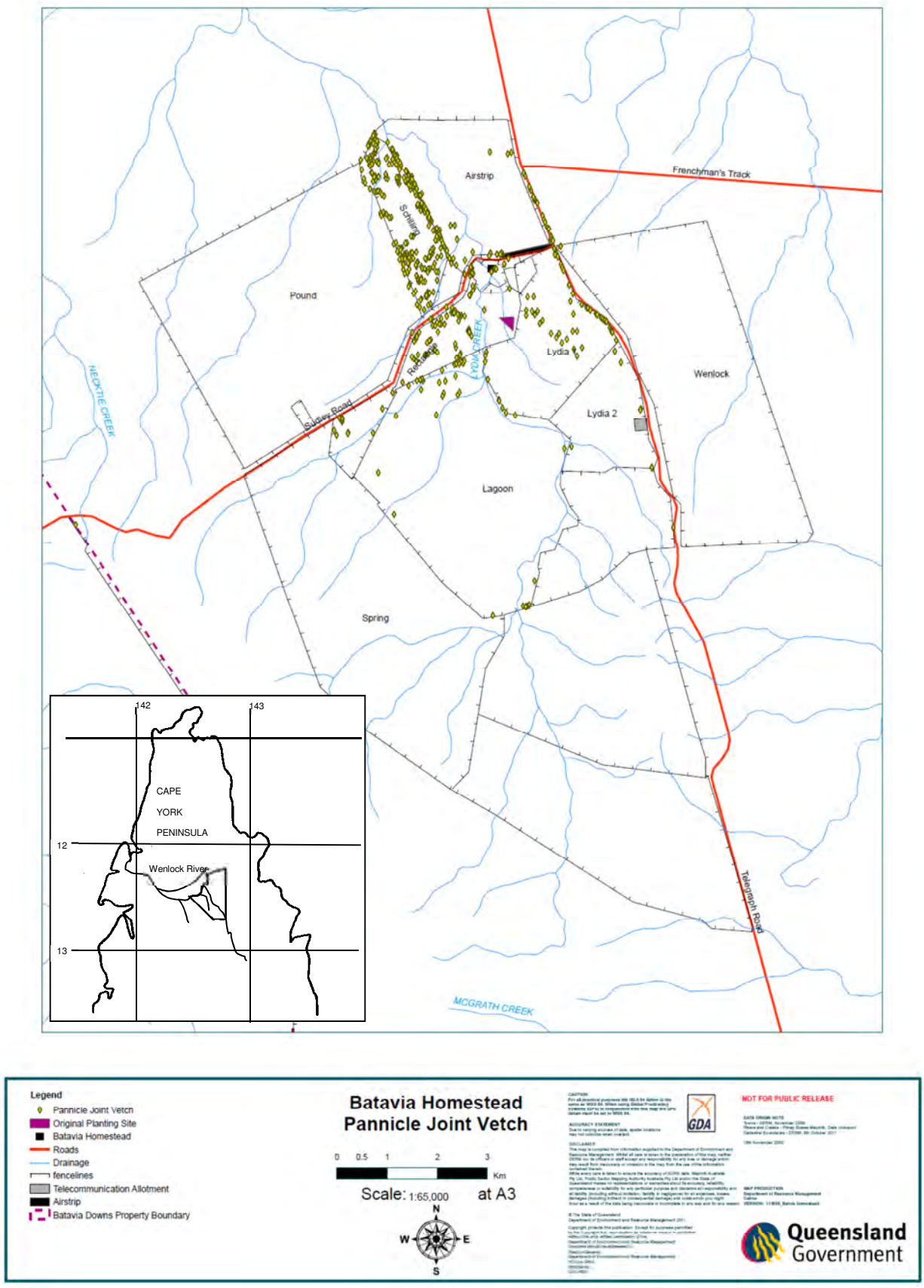


Figure 3 Location of 'Batavia Downs' Station, North Queensland and paddock boundaries as defined during surveying in 2006/07. *Aechynomene paniculata* distribution as for 2011.

Table 9. Activities undertaken by DAFF staff at 'Batavia Downs' and 'Sudleigh' to monitor and treat outlier *Aeschynomene paniculata* populations.

Paddock or site	Paddock area to cover (ha)	Visit dates	Activities completed S = survey, T = treatment, D = discussion with manager, P = practical demonstration	Control method H=herbicide C=cultivation M=manual F=fire	Officer work time on site (hrs)[1]	Plant population (calculated estimate)	Number of new patches marked by GPS
Lydia 1	511	Nov-11	T	M	4	100	DNR[2]
Lydia 2	447	May-12	S,T	H,M	10	500	30
Lydia 3	2[4]	May-13	S,T	H,M	10	200	10
		May-14	S,T	H,M,D	8	100	6
Schilling,	307	Apr-11	T	H,M	10	2000	-
Airstrip,	670	May-11	T	M	64	10000	-
Rectangle,	71	Aug-11	S,T	M	48	4000	80
Pound,	5 (1870)[4]	Nov-11	S,T	M	28	600	70
Lagoon,	1385	May-12	S,T	H,M	70	2500	120
Wenlock	1 (1900)[4]	May-13	S,T	H,M	70	1000	70
		Jul-13	S,T	H,M	20	200	6
		May-14	S,T,D	H,M	16	1000	60
		May-14[3]	S,T	H,M	8	75	3 (tot 15)
Non-paddock areas: roadsides etc	100 (est.)	Mar-12	S,T	M	16	200	10
		May-13	S,T	M,H	10	200	10
		May-14	S,T	M,H	8	100	10
Lagoon only	1385	Jun-12	S,T	H,M	73	2600	130
		Jun-13	S,T,D,P	H,M	60	4000	70 (tot 200)
		May-14	S,T	H,M	32	2025	70 (tot 135)
Sudleigh	5 (over 5 km)	Apr-11	S,T,D,P	M,H	10	3500	2
		May-12	S,T	M	32	220	5
		May-13	S,T	M,H	2	30	5
		May-14	S,T	M	4	90	7
		Jul-14	S,T	M,H	6	40	0

[1] equivalent hours of one officer completing activities on-site (not including travel)
[2] Did Not Record number of new sites logged
[3] 'Pound' paddock only
[4] small area within large paddock (xx ha)

The infestation was divided into two key areas within the current phase of the program:

1. *'Core infestation'* comprising the original evaluation site and small paddocks immediately adjacent plus large infestations within nearby 'Schilling' and 'Rectangle'. The total area is approximately 500ha and contains frequent occurrences of *A. paniculata* patches. The best control method is by applying herbicide from quad bikes as early after the wet season as possible to control high numbers of seedlings and completing a follow-up round before too many plants set seed.
2. *'Outlier areas'* including less frequent patches of *A. paniculata* (~3500+ ha) in paddocks adjacent to, or one paddock removed from, the core infestation. These included 'Lydia 2', 'Lydia 3', 'Wenlock', 'Airstrip', Pound' and 'Lagoon Paddocks' plus along roadsides and unfenced areas outside of some paddocks. Detection was more difficult because of the scale of the area to be traversed. The best method was to (1.) *first visit March-May* – locate known points by GPS and treat with herbicide, collecting and destroying any seed if present and marking any new patches by GPS, (2.) *second round* - revisit outlier patches in June-July and hand-pull or chip plants and collect seeds. Additional surveys of previously unchecked areas of paddocks ('Pound' and 'Lagoon') were also completed June-July in each of the three years.

Work in the core areas was undertaken by local staff employed by DATSIMA through ownership transfer agreements. Work in the 'Outlier' areas was completed by DAFF staff (Tables 9 and 10).

Table 10. Key activities undertaken by DAFF officers to support the control of *Aeschynomene paniculata* at 'Batavia Downs', 2011-14.

Activity	Timeframe	Details
Development of management plan	Jun.-Oct. 2011	* Contributed recommendations for the paddock-by-paddock management of *A. paniculata* on 'Batavia Downs'. * Reviewed DERM Management Plan
Employment of indigenous staff for spraying	Sept.-Dec. 2011	* Advised required hours and technical approach to treating the plants in the core area (staff were employed by DERM).
Training staff/familiarisation	2011-14	* For staff trained during 2010 and employed during 2011-12: checking on staff when visiting. * For new staff (1 June 2012): one-day working in the field as a team. * Made and distributed laminated guides for spray mixing.
Provision of accommodation for indigenous staff	2011-14	* Maintained the demountable building moved on-site during the previous phase of the project, including: water, electricity and air-conditioner.
Provision of equipment for controlling PJV	2011-14	* Provided and maintained: -2 x quadbikes -spray-equipment (purchase of 2 tanks) -herbicides, wetters and dyes -safety equipment (masks, gloves etc) -first-aid kits * Applied for an new quad-bike through DAFF which enabled supply of a better quad-bike to replace an older one at Batavia Downs
Replacement equipment and materials	2012-13	* Purchase and supply of: 2 new bike-mounted spray tanks and fittings, herbicide, wetter and dye. * Supply of additional quad-bike
Detecting and controlling plants in outlier populations	2011-14. Refer to Table 10.	* Controlling plants at known GPS-marked points in paddocks and roadways surrounding the core infestation. * Collecting and destroying seeds. * GPS-marking new points. * Reporting results to DERM.
Completing GPS surveys in outlier areas	2011-14. Refer to Table 10.	* GPS-surveys in outlier areas including: roadways; boundaries of Airstrip, Schilling, Trial, Rectangle, Lagoon and Lydia 1-3. * conversion into waypoint files for mapping * Provision to DERM and (later) DATSIMA staff
Quarantine procedures	2012 2013	* Inspected a site proposed for the sourcing of soil for the treatment of a contaminated site dip on Batavia Downs station (a requisite of changing ownership). * Ensured roadways where bitumen was to be laid were free from panicle jointvetch
Handover of Batavia Downs Station	Nov. 2012	* Hand-over of Batavia Downs to the Batavia Indigenous Corporation (Project Leader attended)
Refined spray program	Nov. 2012	* Refined plan for weed control with DATSIMA staff for indigenous staff
Replacement equipment and materials	2012-13	* Purchase and supply of: 2 new bike-mounted spray tanks and fittings, herbicide, wetter and dye. * Supply of additional quad-bike

Activities completed by DAFF project staff – outlier areas

Works undertaken by DAFF staff to support the containment of *A. paniculata* at 'Batavia Downs' are summarised in Tables 9 and 10 (with full details of site visits in Appendix 9.14). The detection and treatment of known *A. paniculata* patches in the outlier areas and surveys of previously unchecked areas were conducted each year. Over 600 work hours were required to cover the 'Batavia Downs' and 'Sudleigh' infestations, with approximately 25 percent of time spent surveying.

Project staff were required to visit in the order of 200 GPS marked patches on 'Batavia Downs' at the onset of the project, increasing to approximately 500 by 2014. A significant number of new patches were detected through completing surveying in previously unchecked areas adjacent to known infestations. Most of these were found in the 'Lagoon' paddock (some 270 patches); this large paddock has now been fully surveyed. A few new patches were also detected along roadsides and along fence lines in 'Pound' paddock; follow-up checks in the areas around these resulted in no new occurrences, but ongoing checks will be required in case seeds have been carried into nearby areas.

Plant populations varied considerably within the outlier areas, but the overall number of plants detected and treated each year was measured in thousands of plants. Plant populations began to noticeably decline over the three-year period as patches were repeatedly visited, plants killed and seed collected and destroyed. Although plants tended to be quite large (1 to 100 plants) and had usually seeded by the time they were first detected, by 2014 many GPS marked patches had no, or only a few plants emerging each year. This suggests only a very low proportion of seeds establish in any one year and rapid progress can be made if an infestation is well delimited and visited regularly.

During 2011, the project team was alerted to the presence of a patch of *A. paniculata* at 'Sudleigh', immediately to the west of 'Batavia Downs'. The patch was found in a gateway approximately 40km from the 'Batavia Downs' boundary. The source of the seed is uncertain, but it is likely it was initially transferred on a vehicle. Project staff met the manager on site in April 2011 and treated plants which were in a dense patch. The treatment was successful and the manager provided follow-up treatment of a few plants. A detailed foot survey (~10km roadway) was conducted during June 2011 in which three new patches were found along the roadside, presumably moved by a grader. The size of the plants indicated they were two to three years old. These were carefully treated and all seeds removed. Follow-up checks were completed each year when plants were considered most easily detected and before seeding.

As for the patches repeatedly treated at 'Batavia Downs', the number of new plants emerging each year at 'Sudleigh' has declined considerably from approximately 3500 (mostly seedlings) during 2011 to only 130 in 2014. Project officers believe the infestation is well-defined and eradication is possible at this site if current efforts (one to two days per year) are continued for another five to 10 years.

Control undertaken by local staff – core infestation

The 'core' infestation in the paddocks immediately adjacent to the plant evaluation site required labour resources beyond the capacity of the DAFF team. The best solution was to train local staff, who could access the site during the wet season when it is best to conduct first round treatments, with DAFF staff supporting their activities.

The transfer of 'Batavia Downs' from Queensland Government to indigenous corporation ownership was a key consideration in the development of weed control protocols on 'Batavia Downs'. The DAFF project team liaised with Queensland Government staff ahead of the transfer of ownership, which involved the partitioning of 'Batavia Downs' into indigenous-owned land, National Park and Nature Reserves co-managed by QPWS (Appendix (9.15). The transfer of ownership was initially conducted by DERM and later by DATSIMA. Originally scheduled for July 2011, transfer of ownership occurred in November 2012 (attended by the Project Leader).

Pest management plans were developed between DATSIMA and DAFF project staff for locally employed and supervised officers to control *A. paniculata* prior to and after the transfer of ownership of 'Batavia Downs' (Appendices 9.16 and 9.17). The Queensland Government provided approximately $20 000 per year for three years towards the control of

A. paniculata at 'Batavia Downs', focussing on the 'core' areas. This was to cover two rounds of treatments each year: ~30 days for two officers to spray young plants between February and April; and ~40 days for two officers to complete follow-up spraying of more mature plants and the collection of seeds between May and September. Supervision was supplied by the long-term caretakers at 'Batavia Downs', who could readily identify the plant and were familiar with control options. The local supervisor kept a record of local officer work activities and hours and provided these to DATSIMA.

DAFF project staff supported local control through the provision of resources, demonstration of practices and alerting local staff to new occurrences of *A. paniculata* on the station (Table 9). The provision of resources became commitments under the property management plan, and included: accommodation (two-bedroom demountable building moved to 'Batavia Downs' in the previous phase of the project), two quad bikes (and often an old spare one) fitted with spray-tanks, personal safety equipment and herbicides (plus surfactants and marker dye). DAFF staff also assisted local staff with plant identification and control methods and safety procedures. These costs were met through B NBP.0706.

The approach of using locally based and supervised labour was highly effective overall. Although detailed surveys were not undertaken in the 'core' areas (because of the time this would require), checks by DAFF staff at the end of each season revealed a noticeable decline in plant numbers in most areas. There have been particular improvements in the small (10 to 20ha) paddocks immediately adjacent to the original plant evaluation site where there has been a concerted effort to control plants for five to 10 years: populations have changed from frequent large patches to occasional plants or small patches. There remain frequent patches in 'Lydia 1' and 'Schilling', but, again, these are less frequent and smaller than for previous years. Importantly, the capacity to treat plants during the end of the wet season when there is often no road access and flexibility is needed to work around rainfall, has enabled better suppression of seeding than in the past. These benefits more than offset any difficulties associated with frequent changes in staff (emphasising the need for flexible and experienced local supervision) and approaches to detection and treatment which were sometimes not as systematic as desired.

It is strongly believed by DAFF project staff that a failure to continue on-ground works as conducted since completing the first detailed surveys in 2006-07 will result in the slow increase and spread of *A. paniculata* within 'Batavia Downs', and this will increase the likelihood of being naturalised more broadly. Queensland Government (DATSIMA) funding for control of *A. paniculata* associated with the transition of 'Batavia Downs' into indigenous ownership ends during 2014, but there may be provision for funding to continue works for one more year (currently being considered). Alternative approaches to funding will need to be considered beyond 2014-15 and this is a priority for any future project activities if the containment of *A. paniculata* is to be seriously addressed as it has to date.

4.3.2 New infestations on Cape York

Aeschynomene paniculata was found at two new locations on Cape York during 2013 ('Strathmay') and 2014 ('Mary Valley'), both approximately 200km south of 'Batavia Downs'. They were detected by a DATSIMA staff member (Simon Thompson) undertaking vegetation surveys as a precursor to transferring the ownership of the properties to traditional owners and the establishment of conservation areas (nature refuges). Simon had been working with DAFF project officers at 'Batavia Downs', so readily identified *A. paniculata*, although specimens were sent to the Queensland Herbarium for verification and to provide official records of distribution. Simon alerted the Project Leader and visits to the sites were undertaken by DAFF and DATSIMA staff to plan surveying and control activities.

A similar approach was used to develop and fund control works as for 'Batavia Downs'. Management guidelines were developed by DATSIMA staff with input from DAFF project staff and control works undertaken using a combination of DAFF and DATSIMA staff and local indigenous rangers. Project B NBP.0706 was used to fund visits by DAFF project staff to complete surveying and assist plant control and contribute towards on-ground control. DATSIMA contributed officer time to survey, map and treat *A. paniculata* on both properties and funded most of the surveying and treatment of *A. paniculata* by indigenous rangers.

Strathmay

'Strathmay' is located on the Coleman River roughly halfway between Musgrave (close to Lakefield National Park) and Pomparaw (Figure 4). *Aeschynomene paniculata plants* were first detected along the northern bank of the Coleman River during vegetation surveys and more plants were found when completing property walks with the traditional owners. The identity of the plants was confirmed and a preliminary survey was undertaken by DATSIMA staff to broadly determine the extent of the infestation. A plant management plan was developed by DATSIMA ahead of a proposed transfer of ownership during 2014 (Appendix 9.18). It was resolved to complete vegetation surveys and treat plants as soon as accessible after the 2013-14 wet season (and prior to the transfer of ownership).

Rangers from the Olkola Corporation (indigenous rangers with connection to the 'Strathmay' area) were commissioned by DATSIMA to complete surveying and treatment of plants during 2014 (Appendices 9.18 and 9.19). The rangers were well-trained and resourced and led by an experienced supervisor. Surveys and treatments were completed 17 to 20 March and included DATSIMA and DAFF staff plus four Olkola rangers. Each patch was marked with a GPS and sprayed with herbicide from quad bikes. Isolated plants were hand-pulled. Some areas were inaccessible due to flooded creeks and lagoons. Despite this, new patches were detected along nearby fence lines and lagoons and maps were prepared (Figure 4). A particularly dense (~2ha) infestation was found near a lick located close to a lagoon. An estimated 15 000 plants were treated in patches over some 4km of river bank and up to 2km from the Coleman River.

A follow-up visit was completed by Olkola staff during 26 to 30 April to check previous treatment areas and to spray a large infestation discovered along a lagoon during the previous survey (when impending rain meant all staff had to leave urgently)(Appendix 9.19). Previous control had been effective, but many plants had been shielded by others and so had not died. A further visit was completed by Olkola Corporation, DATSIMA and DAFF staff during July to check previous control and survey new areas. Previous treatments were considered to be highly effective and few new plants were detected in areas around the previously treated areas. Approximately 1000 plants were treated using herbicides.

The size of the *A. paniculata* patches (some 20m in diameter) and their spatial distribution indicate *A. paniculata* has been present at 'Strathmay' for many years (potentially eight to 12 years). It is unknown how it was originally transferred to 'Strathmay'. The levels of seed in soil will be extremely high, requiring control activity over five plus years. There has, however, been a very positive start to the control works at 'Strathmay' and there remains funding from DATSIMA to continue works for a further two years. Delimitation of the infestation is the key priority. If this can be achieved with some confidence in the next year, there is considered to be a good opportunity to contain *A. paniculata* to the current control areas and kill 90 plus percent of new plants before seeding, thereby eroding soil seed banks.

Mary Valley

'Mary Valley' station is located on the eastern side of the Peninsular Development Road (PDR) and abuts Lakefield National Park. One small patch was found approximately 200 m from the PDR and approximately 50m from a creek (Figure 5). Surveys conducted by

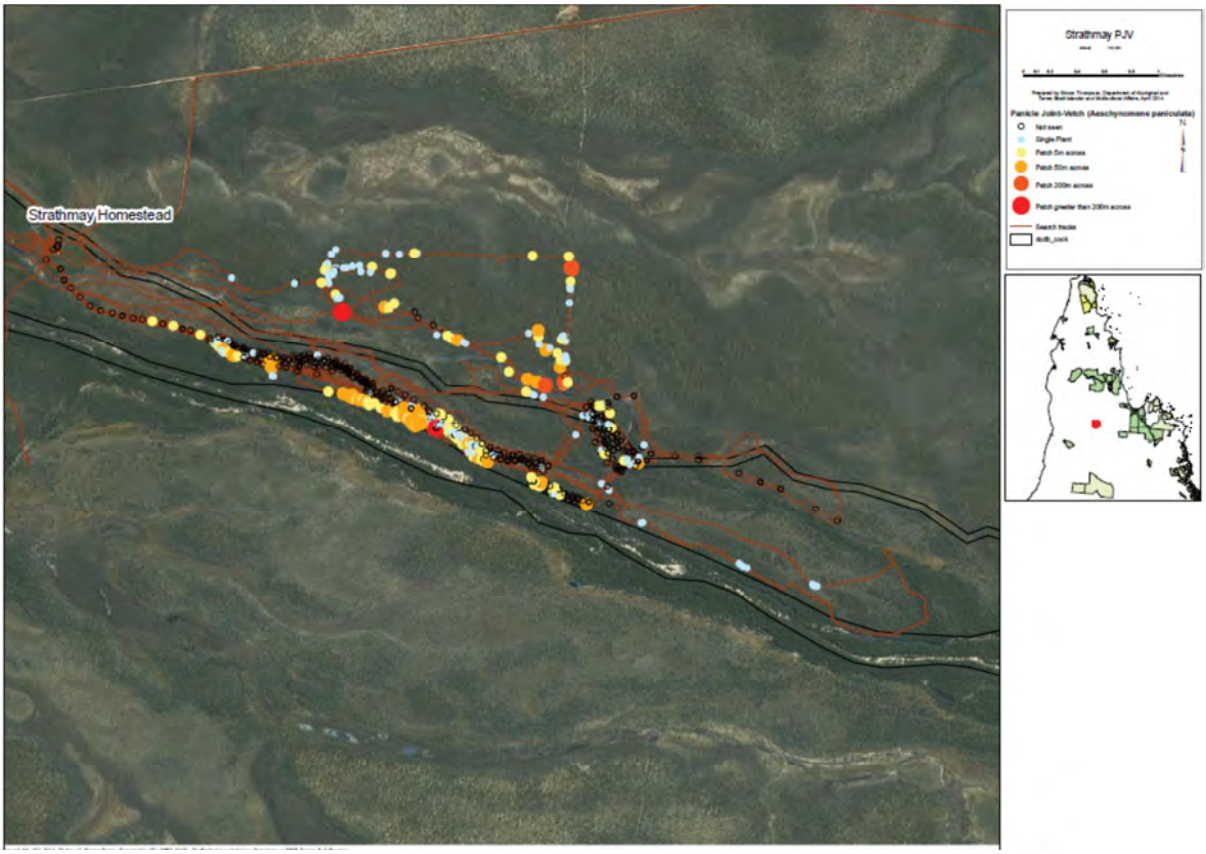


Figure 4 Location of 'Strathmay' Station, Cape York Peninsular, and distribution of *Aeschynomene paniculata* (April 2014).

Figure 5 The single patch of *Aeschynomene paniculata* before and after hand-pulling and collecting seed (June, 2014).

DATSIMA (on foot) and DAFF (using a quad bike) staff indicate this is an isolated patch. All plants were pulled and seeds collected and destroyed. As this was an isolated patch and DATSIMA staff considered there were more significant weed threats present, *A. paniculata* has not been included in property transfer agreements. However, the new owners (since transfer of ownership in August 2014) have been shown the location of the patch and it will be monitored and treated by local DATSIMA and DAFF staff.

The small size of the infestation and extremely convenient access indicate that *A. paniculata* can be readily eradicated from this site. However, vigilance will be required in case seeds have been transferred from the patch in the last few years and have not yet established.

4.4 Management of Aeschynomene brasiliana

4.4.1 Observations of plant frequency and grazing across sites

Twenty sites known to have contained *A. brasiliana* over the last five years were visited to monitor plant populations and observe the level of grazing across a range of growing environments (Appendix 9.20). The sites were mostly in coastal and sub-coastal areas between Mackay and Cairns, but also included a few sites in central Queensland. *Aeschynomene brasiliana* was found at 11 sites, mostly in sites which had previously contained moderate to large populations and mostly north of Mackay. These included sites with a strong dry season component for rainfall (inland sites such as 'Burlington' (Mount Surprise) and 'Braceborough' [Charters Towers]) and those with more regular and higher rainfall resulting in a shorter dry season component (coastal or sub-coastal and elevated sites such as 'Swan's Lagoon' (Ayr), 'Tedlands' (Koumala) and 'Strathdale' [Nebo]).

The frequency of plants varied between sites. The highest frequency of plants occurred at sites where there had previously been large populations and included sites in the wetter ('Swans Lagoon' and nearby 'Dalrymple Dogleg') and drier ('Sugarbag' and 'Burlington') zones. Dense patches were observed at these sites, particularly when growing conditions were favourable (wet season in inland sites and most of the year in coastal sites). Overall, it is considered these populations have increased in number since the cessation of herbicide treatments. However, they had not formed a monoculture at these (or any) sites i.e. had not excluded companion plants, which were mostly perennial grasses (*Bothriochloa, Cenchrus, Chloris, Heteropogon, Themeda* and *Urochloa* spp.), and pasture legumes (*Stylosanthes and Chamaecrista* spp.). Plant populations at other sites have reduced ('Wadeleigh' (Miriam Vale)) or remained similar to previous levels ('Strathdale' (Nebo, frost-prone). These tended to be sites in cooler areas where *A. brasiliana* appears less well adapted.

Flowering, and therefore the potential to seed, was observed at all sites and occurred at most times of the year provided conditions were suitable for growth. This included most of the year in coastal areas, and the wet and early dry seasons in seasonally dry areas of north Queensland. Individual plants left to grow unhindered could produce trailing stems up to 2m from the central 'crown'.

One of the key aims of the recent phase of the program was to confirm (or otherwise) previous observations by project staff that *A. brasiliana* was grazed by cattle; a view supported by observations from other plant evaluation work (Cook *et al*., 2005). Most of the sites were grazed: most were grazed throughout the year, some strategically only in the dry season ('Sugarbag' [weaner paddock]) and at least one only grazed during the wet season ('Braceborough').

Aeschynomene brasiliana was grazed by livestock, but only sparingly when conditions favoured the growth of companion grasses (favourable growing conditions)(Figure 6). As a result, plants tended to grow vigorously over the wet season, producing elongated stems and flowering and seeding before the onset of the dry season proper (here, defined as the time from which grasses begin to hay-off, usually after flowering). Plants were, however, vigorously eaten once companion grasses declined in feed value, presumably as cattle sought more digestible protein and energy. Plants were often grazed to crowns ('Burlington' and 'Sugarbag' as described in detail below). These observations support comparisons with perennial pasture legumes such as *Stylosanthes scabra* (Cook *et al*., 2005), which, although not considered highly palatable in the wet season is considered a useful pasture legume in many seasonally dry environments in Queensland. Although not quantified, *A. brasiliana* was observed to shed leaflets under extremely dry conditions. Cook *et al* (2005) recorded that these can be licked up by cattle, but this was not observed during the project or reported by landholders.

Figure 6 *Aeschynomene brasiliana* at 'Sugarbag' (Mount Garnet) during April (left) and July (right) 2014.

4.4.2 Surveys of plant frequency and grazing at selected sites

Vegetation surveys of *A. brasiliana* plant frequency, growth stage and grazing level were conducted at three sites in north Queensland ('Burlington' (Mount Surprise), 'Sugarbag' and 'Lamonds Lagoon' [both Mount Garnet]). All were on sandy-surfaced duplex soils and had contained large populations of *A. brasiliana* before surveying. Surveys were conducted during December 2012, before wet season rainfall, and in April (very wet) and July (dry) during 2014 (Table 11). Sufficient plants for completing surveys were present at 'Burlington' and 'Sugarbag' but none were found after an extremely hot wildfire (killed many mature trees) at 'Lamonds Lagoon'.

Grazing was managed differently at 'Sugarbag' and 'Burlington': 'Burlington' comprised a population within a large constantly grazed paddock (but where numbers were reduced after mustering in winter), and 'Sugarbag' contained plants within a 40ha weaner paddock. The latter was wet season spelled and heavily stocked after mustering (usually April-June).

The vegetation surveys revealed some consistent trends:

- *A. brasiliana* plants were not readily eaten during the wet season ('Burlington' as stock excluded from 'Sugarbag') and flowering and seeding was well advanced by April at both sites.
- *A. brasiliana* plants were grazed very heavily in the dry season as evidenced by most plants being grazed back to crowns by December 2012. Grazing intensity was highest at 'Sugarbag' where stocking rates were higher.
- Dry-season grazing was most intense at 'Burlington' in the cleared area compared to the surrounding treed area. Field observations indicate this was because many *A. brasiliana* plants growing amidst fallen timber were less easily accessed by cattle than those in the open.
- Plant numbers appeared to increase between December 2012 and July 2014. It is believed this effect may be exaggerated because most plants were very small during the initial survey, whereas most were larger (less grazing) in later surveys. As a result, branches which entered sample areas from outside were included in ratings. However, plant populations are unlikely to have declined under the grazing regimes used, and likely increased to a certain degree.

Overall, *A. brasiliana* was found to be consistently grazed in the dry season, but not until some flowering and seeding is likely to have occurred. Thus, although grazing can be used to decrease plant size and suppress seeding, it does not appear to be able to prevent it and may contribute to the spread of *A. brasiliana* through the gut. *Aeschynomene brasiliana* also tolerated grazing well, regrowing from crowns, and is known to have moderate to high feed

value compared to companion plants during the dry season (Cook *et al*., 2005). These are characteristics considered useful for pasture legumes used in dry-land environments in north Queensland. *Aeschynomene brasiliana* may be more troublesome in areas where it is not grazed or where companion vegetation does not decline notably in quality over the year (coastal environments), because it can form large trailing plants under these circumstances.

Table 11. Frequency and level of grazing of *Aeschynomene brasiliana* plants from transect surveys conducted at two sites in north Queensland.

Site	Survey date	Number of data points	Plant frequency (%)[1]	Frequency of growth stage (% of data points)[2]			Frequency of grazing level (%)[3]			
				V	F	S	NG	Tips	Mod.	Crown
'Sugarbag 1' (Original sowing site within 40 ha paddock)	Dec. 2012 Grazed	120	35.8	100	0	0	0	0	0	100
	April 2014 Not grazed		79.2	11.8	48.2	40.0	100	0	0	0
	July 2014 Not grazed		78.3	22.0	0	78.0	70.2	4.3	18.1	7.4
'Sugarbag 2' (Nearby patches within 40 ha paddock)	Dec. 2012 Grazed	120	24.2	100	0	0	0	0	0	100
	April 2014 Not grazed		41.7	16.7	45.8	37.5	100	0	0	0
	July 2014 Not grazed		47.5	26.9	0	73.1	8.4	21.1	10.5	0
'Burlington 1' (Original cleared sowing site)	Dec. 2012 Grazed	120	13.3	86.7	13.3	0	18.8	0	6.3	75.0
	April 2014 Grazed		35.0	55.6	27.8	16.7	100	0	0	0
	July 2014 Grazed		25.8	78.9	0	21.1	3.2	12.9	12.9	71.0
'Burlington 2' (Treed areas around original sowing site)	Dec. 2012 Grazed	100	8	100	0	0	25.0	25.0	12.5	37.5
	April 2014 Grazed		26	55.0	37.5	7.5	100	0	0	0
	July 2014 Grazed		17	45.5	0	54.5	52.9	17.6	17.6	11.8

[1] Percentage of data points containing one or more plants.

[2] Growth stage(s) of plants observed in data point zone (~ 1 m^2 directly in front of officer):
V = vegetative; F = flowering with no mature seed; S = mature seed present

[3] Level of grazing of the majority of plants observed in the data point zone:
NG = not grazed; Tips = leaf or stem tips only; Mod. = grazed back to a compact plant (~10-30 cm diameter); Crown = grazed back to crowns (<10 cm diameter, usually less than 5 cm)

4.5 Information transfer

4.5.1 Landowner engagement and participation

There was a greater level of landowner engagement than for previous phases of the project. Officers were requested to report the activities undertaken during each visit to the project leader (Appendix 9.25) and these were classed into four categories: inspection by an officer (I), treatment of plants by an officer (T), discussion of best management and the development of management plans with the landholder/manager when plants were found (D) and practical demonstration of the plant (identification) and control methods to the landholder if plants were present (P) (Appendix 9.10). Conversations to arrange and state the purpose of a visit were not considered to be discussions. The complete detail of all engagement activities undertaken at each visit were not always reported, but the information provided was considered sufficient to gauge landholder engagement at a site. Landowner

engagement and participation broadly varied with the best management of each species, so they are treated separately here:

Acaciella angustissima
Inspections were conducted at all sites except 'Charlieville Laboratory', which is considered long-term clean. Five of the 16 remaining sites had no plants detected, so no treatment and demonstration was necessary. Local control was completed at 'Helen's Hill' (Hinchinbrook Regional Council), 'Lansdown 1' (CSIRO) 'Walkamin', 'Brian Pastures' and control at 'Parkhurst' (all DAFF facilities) and nearby 'Etna Creek' has recently been transferred to the local Queensland Government weeds officer. Wellards Pty. Ltd. and the Townsville Regional Council provided substantial assistance in controlling the largest known infestation at 'Lansdown 2'. Exclusive project officer control on non-government properties was undertaken at a roadside area outside the Etna Creek Correctional Facility and 'Hillgrove' (both with occasional plants) and at 'Warrill View' (20-50 plants per year) to kill plants and prevent seeding as landholders were difficult to meet on-site. The 'Campus Creek' site adjacent JCU in Townsville was managed by the local project officer because he was located within a few hundred metres of the site and plant populations were low.

Aeschynomene paniculata
Nine sites were found to contain *A. paniculata* (including the three Cape York sites discussed above). The approach of developing collaborative management and funding arrangements to support local control on Cape York has been highly successful, enhancing detection and treatment of infestations. Project officers discussed management of the other sites with all of the owners and completed practical demonstrations of control at two (note, these had already been conducted at the moderate to large 'Strathdale' and 'Tedlands' sites during the previous phase of the project) and it is considered landholder awareness of the plants has improved over the last few years.

Unlike *A.* angustissima, A. *paniculata* is highly mobile and there is a relatively short opportunity to treat plants before seeding. All sites were in pastures, often woodlands, so the only option to control plants was to systematically survey known infestation areas, identify the target plants and spray with a selective herbicide (or hand-pull for small populations). Project officers undertook control of *A. paniculata* at most sites as it became apparent local control would not always be optimal. Reasons for this included: landholder difficulty in detecting *A. paniculata* plants where similar plants were present (*Aeschynomene americana*), particularly in vigorous pasture; landholders having time and labour constraints to undertake control, particularly at larger sites; and the project team being better equipped (quads with spray tanks) to complete activities at sites with large populations (simply easier to treat plants when visiting to monitor populations). Recent sales of government properties ('Southedge Research Station' and 'Swans Lagoon') threatened to interrupt weed control, but provisions to gain access to sites in transfer agreements allowed continued control of plants by project officers.

Indigofera schimperi
Indigofera schimperi is relatively immobile and easy to detect in small areas, but can be difficult to identify as it is can become confused with other *Indigofera* spp. and seedlings can be difficult to detect in dense pasture. Seeding can occur within three to four months of significant rainfall events so control (usually herbicide or digging out/grubbing) should be conducted as often as possible. All of these features suggest regular local control is beneficial, with support from project staff to assist with identification.

Twenty-seven sites were found to contain *I. schimperi* over the last three years. Populations were low (less than 100 at 70 percent and less than 1000 at the remainder) and were restricted in distribution at all but one site. Project staff discussed identification and

management of *I. schimperi* with landholders at most sites to increase landholder monitoring and control by landholders.

Overall, there has been good progress towards collaborative management of the *I. shimperi* sites. Local control is now being undertaken at approximately half of the sites containing *I. schimperi.* Activities include: monitoring and spraying herbicides, cultivation and slashing to suppress flowering. Project officers undertook plant control at the other sites, and undertook complementary control activities at some of the sites under local control. The exception was at 'Bluff Downs' (Charters Towers), where a few struggling plants have been found in the past, as the owner did not support a visit to look for plants.

Changes of ownership complicated control of *I. schimperi* at some sites as new landholders needed to be engaged. Some involved private sales (e.g. 'Carramah' and 'Myuna') and others involved transfer out of government ownership ('Narayen', 'Brigalow Research Station' and 'Emerald Research Station' ', see below). Unfortunately, mismanagement of the site at the old DAFF 'Emerald Research Station'' has resulted in seeding events and potentially transfer of seeds during the transfer from DAFF to the Central Highland Regional Council. Discussions and demonstrations have now been conducted on site and a management plan developed, although *I. schimperi* will likely have lesser priority than declared weeds in the region. Control at 'Narayen' is also less than optimal (mostly grazing and slashing with some spot-spraying) as labour resources to undertake works at the Pastoral College are scarce. The population is believed to be contained, however, and not increasing in number.

Aeschynomene brasiliana

Project officers visited all of the locations where *A. brasiliana* was present at the end of NBP.356, although not with the same frequency as for the three species prioritised for control (one to three visits). Plant growth, seeding and the level of grazing was recorded (Section 4.4.1) and detailed vegetation surveys were completed at three locations in north Queensland. Project officers completed control of plants at a few sites, usually while treating one or more of the other target spp. ('Strathdale', 'Granite Vale', 'Walkamin RS').

Project officers discussed their activities and current approaches to management of *A. brasiliana* with landowners. Again, changes of ownership complicated management at some sites containing significant populations of plants ('Burlington', 'Swans Lagoon'). Landholder contributions to managing *A. brasiliana* were mostly to graze areas containing plants (often not a deliberate management tool) thereby suppressing seeding. This was most successful in areas of north Queensland with an extended dry season, but is expected to have done little to reduce plant numbers. It should also be noted that grazing can spread *A. brasiliana*, as occurs for other pasture legumes (e.g. *Stylosanthes scabra*) (Cook *et al.*, 2005), and has likely contributed to spread at some of these sites.

Six sites currently have large (1000+ plants) populations of *A. brasiliana* and, of these, *A. brasiliana* is considered widely naturalised at three ('Burlington', 'Sugarbag' and 'Swans Lagoon'). It may also be widely naturalised at 'Braceborough'; surveying after wet season rainfall is required to determine distribution. Other significant populations at 'Tedlands' and 'Dalrymple Dogleg' are considered to be relatively well contained. The other populations are small, and considered well-contained.

4.5.2 Broader engagement

In some cases it has been necessary to engage agencies beyond the immediate landholder level to maintain control of the target plants. Situations where this applies include transfer of ownership from a government facility to new owners (private or indigenous corporation) or where the land is being leased (from, say, a Regional Council). Some examples follow:

1. Sale of Queensland Government Agencies to private ownership: 'Southedge Research Station'' (*A. paniculata* and *A. angustissima*); 'Swans Lagoon RS' (*A. brasiliana* and *A. paniculata*); 'Toorak Research Station'' (*A. angustissima* [suspected clean]); and 'Brigalow Research Station' (*I. schimperi*).
2. Transfer of Queensland Government properties to Regional Shire Council ownership: e.g. 'Emerald Research Station'' (*I. schimperi*) to the Central Highlands Regional Council.
3. Transfer of Queensland Government properties, initially from DAFF (or equivalent) to other Departments before transfer to management by indigenous corporations on Cape York Peninsular: 'Batavia Downs', 'Strathmay' and 'Mary Valley' (all *A. paniculata*).
4. Transfer of a Federal Government (CSIRO) property to an Agricultural College: 'Narayen Research Station'' (*I. schimperi* and *A. brasiliana*).

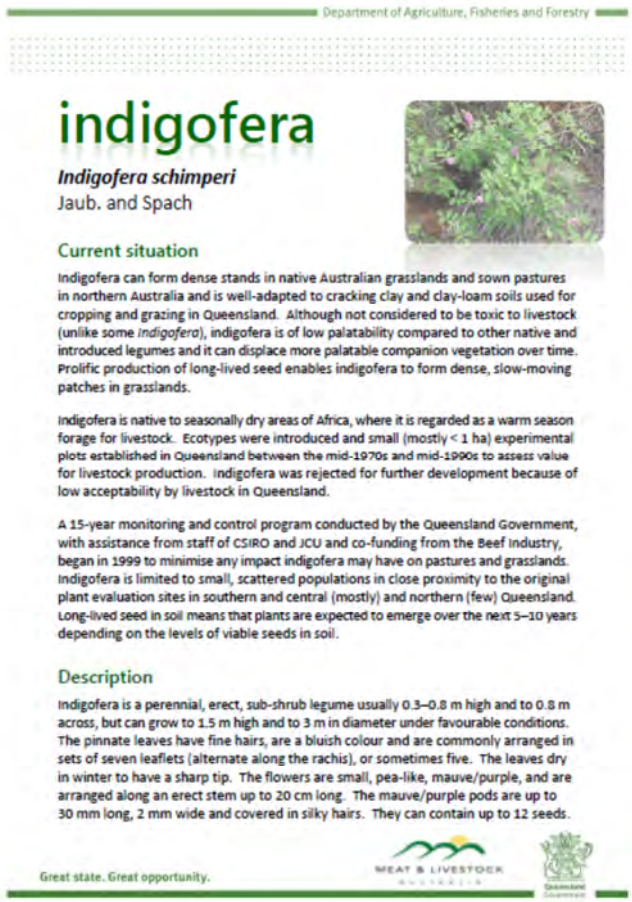
New owners were made aware of the presence of any of the target legumes on the properties and details were often incorporated in ownership transfer agreements to allow continued access of Queensland Government staff to the sites to monitor and treat plants (e.g. 'Southedge Research Station'' and 'Swans Lagoon Research Station'). Detailed plant control plans were developed and additional funding sourced to undertake surveying and control works on some sites of particularly high strategic importance (the Cape York *A. paniculata* sites).

Regional council weed and pest officers were engaged at a number of sites. Some sites were on Regional Council land and included the Class 1 Declared *A. angustissima* (therefore legally under their responsibility to contribute to control) e.g. 'Helen's Hill' (Hinchinbrook Regional Council), 'Campus Creek' and 'Lansdown 2' (both Townsville Regional Council). Others were not declared plants but fell under Regional Council control (*I. schimperi* at 'Emerald Research Station''). Some non-declared plants, not necessarily on council land but considered of high strategic importance, were also included in Regional Council pest management plans to alert officers of the significance of the plant and aid detection: *A. paniculata* on Cape York was included in the Cape York Peninsular Pest Management Plan. Project officers also contacted regional council pest management staff and met them on private properties to discuss the plants and their control e.g. *I. schimperi* at sites within the Goondiwindi and Toowoomba Regional Council areas.

4.5.3 Information sheets

Information sheets were produced for each of the four legumes. They were designed to assist landholders decide whether to control each of the four species and included methods to identify and treat the legumes should they decide to undertake control. The information sheets contain the following: species origin, physical description and similar species; growth characteristics in Queensland and official weed status; the weed control program; effective methods to control the plant; and sources for further information. The fact sheets can be found in Appendix 9.21 and the front page of the *I. schimperi* sheet is presented in Figure 7.

The content of the information sheets was developed using project officer experience and the Queensland Government weed risk assessments completed in the previous phase of the program. Weeds policy and technical expertise was provided by DAFF specialists. Whereas first drafts were completed by late 2013, the sheets were not completed until mid-2014 because of the need to review content to meet legal requirements (particularly permits for the use of herbicides). Although later than originally planned, the project team has now begun to use the information sheets when visiting landholders or when liaising with other stakeholders. The sheets are available in hard copy or as a .pdf.



Department of Agriculture, Fisheries and Forestry

indigofera

Indigofera schimperi
Jaub. and Spach

Current situation

Indigofera can form dense stands in native Australian grasslands and sown pastures in northern Australia and is well-adapted to cracking clay and clay-loam soils used for cropping and grazing in Queensland. Although not considered to be toxic to livestock (unlike some *Indigofera*), indigofera is of low palatability compared to other native and introduced legumes and it can displace more palatable companion vegetation over time. Prolific production of long-lived seed enables indigofera to form dense, slow-moving patches in grasslands.

Indigofera is native to seasonally dry areas of Africa, where it is regarded as a warm season forage for livestock. Ecotypes were introduced and small (mostly < 1 ha) experimental plots established in Queensland between the mid-1970s and mid-1990s to assess value for livestock production. Indigofera was rejected for further development because of low acceptability by livestock in Queensland.

A 15-year monitoring and control program conducted by the Queensland Government, with assistance from staff of CSIRO and JCU and co-funding from the Beef Industry, began in 1999 to minimise any impact indigofera may have on pastures and grasslands. Indigofera is limited to small, scattered populations in close proximity to the original plant evaluation sites in southern and central (mostly) and northern (few) Queensland. Long-lived seed in soil means that plants are expected to emerge over the next 5–10 years depending on the levels of viable seeds in soil.

Description

Indigofera is a perennial, erect, sub-shrub legume usually 0.3–0.8 m high and to 0.8 m across, but can grow to 1.5 m high and to 3 m in diameter under favourable conditions. The pinnate leaves have fine hairs, are a bluish colour and are commonly arranged in sets of seven leaflets (alternate along the rachis), or sometimes five. The leaves dry in winter to have a sharp tip. The flowers are small, pea-like, mauve/purple, and are arranged along an erect stem up to 20 cm long. The mauve/purple pods are up to 30 mm long, 2 mm wide and covered in silky hairs. They can contain up to 12 seeds.

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Figure 7 First page of the *Indigofera schimperi* information sheet completed 2014. .

4.6 Surveys of producer opinions

Project officers collaborated with landholders to undertake works on their properties. During visits in the last year of the project, project officers were able to canvass landholder opinions on the target plants and their capacity and willingness to help with controlling the plants in the future. Project officer opinions of plant population status, works undertaken and landholder contributions were reviewed during an August 2014 project planning meeting (Appendix 9.22). As a follow-up to this meeting, telephone surveys were also completed in October 2014 to better understand landholder opinions of the plants and their capacity and willingness to help control these in the future (Appendix 9.23). The surveys were conducted for selected sites, including most of those known to contain populations of the target plants at the end of the project. The surveys were treated as confidential, although some property owners did not think this was necessary. A summary of the results is presented in Table 12.

Perceived weediness of the target plants

Overall, the four target weeds have had minor impacts on producer operations. Nearly all landholders interviewed believed the target plants had not impacted negatively on their operations, often because control efforts had contained and reduced plant populations to inconsequential levels. One producer thought that *A. brasiliana* was potentially useful as an alternative pasture legume (to *Stylosanthes scabra* and *Chamaecrista rotundifolia*) as it was eaten during the dry season and was not dominating grass pastures. The exception from those interviewed was for *Acaciella angustissima* at 'Lansdown 2', where the owner had contributed considerable time and resources to renovate an area containing a dense thicket, thereby enabling more effective control using herbicides (completed by project staff).

Table 12. Summary of landholder opinions following discussions between project staff and landholders and phone surveys conducted in October 2014.

Activity	*Acaciella angustissima*	*Aeschynomene brasiliana*	*Aeschynomene paniculata*	*Indigofera schimperi*
Number of sites known to have plants by 2013- 2014	6	9	5	16
Number of interviews:				
- Phone	5	5	4	11
- During visits	0	2	0	3
- Project officer sites[2]	2	1	1	1
- Sole local control[2]	1	0	0	0
- Ownership change[3]	1	1	1	3
Perceived weed potential on property				
Currently impacting?				
- Yes	1	??	0	0
- No	4	5	4	14
Potential to impact?				
- Yes	4	???	2 (+?)	14
- No	1	4	1	0
Key weeds on property? (most frequently nominated first)	Leucaena, lantana, lions tail, grader grass, rubber vine, chinee apple	Lantana, GRT, Sicklepod, Chinee apple, Rubbervine, Parthenium	Lantana, GRT, Rubbervine, Sicklepod, Chinee apple, Parthenium, Flannelweed	Parthenium, GRT, Mimosa, Rubbervine, Parkinsonia, Mother of millions
Compared to key weeds?				
- Worse	0	?	0	0
- Similar	1	0	0+?	?
- Less	4	6 (eaten)	3	13
Continue with control?				
- Yes	5	3??	3	14
- No	0	2	1	0
Capacity to identify plants				
Can you identify?				
- Yes	2	2	1	6
- No	3	5	3	8
Photo guides help?				
- Yes	5	6	4	14
- No	0	1	0	0
Willingness to contribute to future control (where control desired)				
Will you contribute?				
- Yes	4	6 (graze)	3	11
- No	1	0	1	3
Allow project staff access?				
- Yes	5	7	4	14
- No	0	0	0	0
Desired level of Project Officer assistance (where control desired)[2]				
Own control with:				
- no help from project staff	2	0	0	2
- identification assistance	1	0	1	1
- regular visits and control	1	2	2	10
- supply of herbicides	1	1	2	3
- uncertain of need	0	2	0	0
Control by project staff	2	3	4	9

[1] future control likely because of project officers on site of very effective long-term local control (sole)

[2] more than one level of assistance expressed by some landholders

[3] owner has very little experience with the target plant(s) because of recently taking property ownership

? unsure

It is clear the large infestations of *A. paniculata* on Cape York Peninsular have imparted considerable cost in terms of money (wages and equipment) and time (supervision and project management) to staff at 'Batavia Downs' and DATSIMA, and utilised the time of on-ground staff when they could have been completing other tasks.

Most landholders considered the unpalatable plants to have weed potential should they not be controlled. *Acaciella angustissima* was considered to have potential to impact negatively on enterprises through the formation of dense, unpalatable thickets, although some believed the potential for severe economic impact was low because it had not spread. *Aeschynomene paniculata* was also considered to have significant weed potential by most producers because it was unpalatable and persistent, although some owners thought it posed a minor threat because it had only grown poorly and had not spread on their properties. Although considered of significant weed potential by many producers, these weeds were generally considered less significant than others on their properties (lantana, giant rats tail grass, rubbervine, sicklepod, chinee apple, parthenium and flannel weed). Interestingly, some landowners considered *A. angustissima* to be less weedy than leucaena and other exotic *Acacia*, because it was less mobile.

There was some landholder concern over *I. schimperi*, despite having small and well contained populations at most sites and having no appreciable impact on their operations to date. *Indigofera schimperi* was consistently regarded as less of a weed than other species: parthenium, giant rats tail grass, mimosa, rubber vine and mother of millions, to name a few. Most producers were aware that *I. schimperi* is unpalatable to livestock and persistent. A few landowners were highly concerned by *I. schimperi* and expressed a need for project officer control as duty of care.

There was least concern over *Aeschynomene brasiliana*, mostly because owners had seen it grazed, and it was consistently ranked as a lesser concern than other weeds on properties. Some landholders were, however, unsure of its long-term potential impacts and this reflected uncertainty as to whether it needed to be controlled.

Capacity to identify the target plants

Landowners, overall, were not confident at identifying the target plants if they were outside of their normal control areas. Understandably, those with larger infestations generally had greater confidence than those with small populations. Although most producers did not nominate plants which were similar to the two targeted *Aeschynomene* species, some stated that the *A. angustissima* could be readily confused with leucaena (*Leucaena leucocephala*) and other *Acacia/Acaciella* spp., and *I. schimperi* with other *Indigofera* spp. The use of photographs (through information sheets) as an identification aid was universally seen as useful, although a few landholders preferred identification by an expert.

Willingness to assist control of the target plants in future

Overall, landholders were keen to assist in the control of the target plants. This extended to offers to continue cultivation (where possible), spot-spray or remove plants in small populations and report any new incidences to project staff. Future access of project staff to sites of the landowners interviewed is encouraged, although there has been difficulty accessing one small *I. schimperi* site in north Queensland and there have been recent reports of a disgruntled owner at a southern Queensland where no plants have been found in the last two years.

Land owners consistently requested assistance from project staff, however, especially frequent visits to monitor plant populations (assist with identification) and provide advice on management. Some owners were keen for project staff to undertake control of plants if possible, and a few saw control by project staff an imperative as a 'duty of care'. Although

the supply of herbicides was welcomed by a few owners (some *A. paniculata* and *I. schimperi* sites), this was not requested by the majority of landowners.

Continued control of *A. brasiliana* was not considered necessary at a few sites and generally owners were happy to continue to graze areas known to contain *A. brasiliana* (often no change in management practice). Uncertainty regarding the potential for *A. brasiliana* to become a weed meant that some owners were unsure as to whether plants needed to be controlled, or whether they were useful. This is understandable due to the change in approach towards the management of *A. brasiliana* over the course of the program (initially nominated as a weed to be controlled and later considered to be more benign as evidence of grazing was recorded). Recent discussions between project staff and landowners and the supply of information sheets which detail the perceived level of weed potential will hopefully help landowners with their decision making.

5 Success in achieving objectives

5.1 Overall

There has been good progress towards meeting project objectives. The restructuring of the project to place priority on the control of the three unpalatable species overcame many of the time pressure issues presented in the previous phase of the program, whereupon a considerable proportion of project resources were spent treating large *A. brasiliana* populations in north Queensland (where it is grazed). On-ground works were mostly completed as scheduled although two project staff had to be employed post-retirement to achieve this outcome. With only a few exceptions, the few sites not visited were those considered to be 'clean'.

There has been good progress toward the erosion of soil seed banks at most sites, and no plants were detected at some sites where they had previously been found. However, seeding occurred at some sites containing larger plant populations and control efforts will need to be continued for many years to ensure containment and a reduced risk of spread through reducing plant populations.

The discovery of previously unknown sites containing *A. paniculata* on Cape York Peninsular during 2013-14 is of concern following good progress defining and treating (with considerable local and State Government support) the large infestation at 'Batavia Downs'. The delimitation of populations, treatment of plants and development of site management plans in collaboration with DATSIMA and indigenous ranger group staff used considerable project resources over the last year, requiring a three month extension to the project.

Attempts to increase landholder involvement in controlling the target plants had variable results, but overall there has been an increase in landholder participation and there are good intentions for this to continue in the future. Overall awareness of the plants has considerably improved following discussions on-site with project staff and the development of information sheets, albeit towards the end of the project.

5.2 Specific Objectives

Objective 1. For the sites previously treated in B.NBP.0356 and containing *A. paniculata* (except Batavia Downs), *A. angustissima* and/or *I. schimperi*:

(a) Prevented seeding at all sites less than 5ha in area and minimised seeding at larger sites

Although an ambitious objective (as thousands of plants can be contained within 5ha), there has been good progress toward completion. A significant seeding event is only known to have occurred at one *A. angustissima* site ('Lansdown 2', (~5ha) prior to clearing a dense thicket of mature trees and detecting plants in a nearby creek) and was prevented at all small *A. paniculata* sites. Seeding did occur, however, at eight of the 25 *I schimperi* sites containing plants over the three years and with areas less than 5ha, and may have occurred at one other site which has previously contained a few poorly adapted plants but access to the site was discouraged by the landowner. Major seeding events occurred at four sites, with only a few plants seeding at the others. Four of the sites had more than 100 plants. Seeding occurred during changes of ownership and manager at two of the properties, but missed at the others following mis-timed visits.

(b) Contained any plants to within the control area of each site

The three target species were not detected beyond known control areas at nearly all sites. Exceptions included: mature *A. angustissima* plants found along a creek immediately adjacent to the core fenced area at 'Lansdown 2'; and *I. schimperi* plants, which have spread from the original plant evaluation site at 'Birrong' into nearby paddocks linked to the evaluation site through a cell grazing system. Both sites are now being well-managed. The new areas of *A. paniculata* on Cape York also represent new detections, but are beyond the scope of this objective (addressed below). It should be noted that, although project staff checked areas immediately around the control areas of each site, detailed surveys were not completed in surrounding areas. It is possible, therefore, that plants may have spread and not been detected. There were no other reports from landowners or external agencies of new occurrences of the three target species.

(c) Engaged landholders at each site to transfer decision making and on-ground treatment of plants from project agency staff to the respective landholders

Engagement with landholders has increased considerably during the project resulting in increased landowner participation in on-ground treatment of plants (Section 4.5; Appendix 9.10). Project staff discussed the identification and control of the target plants on-site at nearly all sites where plants were present and most where no plants were found. Exceptions included sites completely under local control (*A. angustissima* at 'Helen's Hill', Hinchinbrook Regional Council) and those where it has been difficult to meet the landowner (often new management) on site (*A. paniculata* at 'Southedge Research Station'' and some *I. schimperi* sites).

Landholder participation in controlling the three target plants has increased over the last three years, but project officers are exclusively controlling plants at some sites. Seven of the nine sites known to recently contain *A. angustissima* now have local control, albeit with checks and (for some) occasional treatment of plants by project staff (two sites are project officer workplaces). Regional Shire Councils and DAFF lands protection officers are now overseeing works at four sites as this declared species falls under their jurisdiction. Local control of *I. schimperi* is now being undertaken at approximately half of the sites, with activities including applying herbicides, cultivation and slashing to suppress flowering. In addition to treating the other sites, project officers are, however, completing additional weed control at some of the sites e.g. spraying emerging plants in areas cultivated by the landowner if not otherwise controlled during crop spraying or treating plants in nearby areas.

Transfer of the management of controlling *A. paniculata* to landholders has been less successful and project officers have completed works at most sites. This has proven to be a more difficult plant to treat than the others because it is relatively difficult to detect and identify. It flowers and seeds relatively rapidly after establishing and has proven more mobile than the others. The populations tend to be larger and spread over greater areas. Many of the landowners do not have the confidence to identify plants in pastures/woodlands before seeding or have a limited capacity to treat plants (equipment and time). In the absence of local control, project officers opted to complete weed control themselves using effective project equipment (quad bikes with mounted sprayers and GPS) and their experience with the sites. When interviewed at the end of the project, however, some landowners said they would be prepared to control the plants in the future, but would like assistance from project staff (identification, control plans and some treatment of plants).

The accurate identification of plants remains an issue for control at many sites, despite being shown to landowners. Each have fairly similar species commonly found at some of the sites: *A. angustissima – Leucaena leucocephala*; *A. paniculata – Aeschynomene americana*;

I. schimperi – other *Indigofera* spp. The photographs and descriptions in the information sheets will hopefully assist future identification.

Based on the discussions and surveys conducted over the last two years, there appears to be good potential to further increase landowner participation for control (Section 4.6). However, control will best be achieved with input from experienced project staff as they are highly motivated, can confidently identify the plants, are well equipped for efficient treatment and can help develop management plans.

(d) Supported landholder management of the target plants, including demonstration of control and the provision of materials and advice

As well as completing control works themselves, project staff provided considerable support to landholder control to the target plants. Through on-site discussions and practical demonstrations (Section 4.5, Appendix 9.10), landholders were familiarised with the identification and growth characteristics of each of the target plants and methods recommended for control (note: many remained uncertain of accurate identification by the end of the project). Landholder intervention was encouraged where it could aid the control of plants (cultivation, removal of vegetation which may interfere with control, grazing to enable detection). Landholders did not generally request herbicides to kill plants, although terbuthiuron (residual selective herbicide) was left at a few sites to be sprinkled around plants if found.

Visits to properties containing plants were conducted regularly to monitor plant populations and update landowners on plant distribution. Project officers controlled any plants they found (back-up control) when visiting properties under local control and collected and destroyed any seeds. The regular visits resulted in (mostly) amicable relationships between project officers and landowners and this served to encourage local weed control when landowners placed control of the target plants down their list of priorities. These reminders, sometimes done over the phone, are considered one of the key benefits of the project.

The capacity to support local control was sometimes limited by the number and availability of project staff as other work priorities sometimes conflicted with optimum visiting times. Two experienced officers were employed post-retirement to cover sites in southern and central Queensland, and an additional officer was engaged late in the project to cover sites around Mackay.

(e) Documented plant population changes, and the transitional and ongoing management arrangements, at each site.

Plant population changes were documented at all sites visited, as well as works undertaken for control and the perceived level of seeding. These were reviewed annually and are summarised in this report (Appendix 9.10). Sites containing larger populations were visited most frequently, and thus have the more complete data sets. It should be noted that accuracy of plant population counts declined as populations became larger and more widely spread. Because officer time was limited and large populations were difficult to measure, a logarhythmic score system was used for plant population (1 = 1-10 plants, 2 = 10-100 etc.). A deficiency of this system is that it made it difficult to clearly identify a decline in population until it was very significant.

Progress towards eradication is presented and discussed in Section 4.2.5. In brief, plant populations declined or were similar to those at the start of the three year project at most sites and each of the target species now have a high proportion of sites with no, or fewer than 10 plants emerging annually: *A. angustissima* 90 percent; *A. paniculata* 63 percent; *I. schimperi* 68 percent. Each species does, however, have a few sites with large

populations. These tend to be relatively well contained for *A. angustissima* and *I. schimperi*, but more widespread for *A. paniculata*.

Arrangements to control plants were informal and based on a positive two-way dialogue between project officers and landholders. These activities were recorded by project officers and forwarded to the Project Leader for record keeping, planning and reporting purposes. Formal control plans were developed for a few sites requiring considerable collaboration between landholders and outside agencies e.g. control of *A. angustissima* at 'Lansdown 2' (Section 4.2) and management of the three *A. paniculata* sites on Cape York Peninsular (Section 4.3).

Discussions and interviews between project staff and landholders conducted towards the end of the project have provided project staff with a greater appreciation of landholder views on the weed potential (or otherwise) of *A. angustissima*, *A. paniculata* and *I. schimperi*, the capacity of landowners to identify plants and their willingness to undertake control in the future (Section 4.6). Although many landholders do not see the target plants as potentially one of the worst weeds on their properties, there is a general willingness to undertake control or support control by project officers. Control by landholders was almost universally contingent on collaboration with project staff.

Objective 2. At Batavia Downs:

(a) Developed a long-term strategy for the containment of *A. paniculata* with the landholders, namely Queensland Parks and Wildlife Service (ex DERM) and the Batavia Indigenous Corporation.

There has been good progress towards the achievement of this objective (Section 4.3). The infestation of *A. paniculata* at 'Batavia Downs' is the worst infestation known in Australia, including tens of thousands of plants requiring treatment each year over thousands of hectares of woodland. Access is difficult to the property during the wet season (road closures), when plants are most efficiently controlled before seeding (using herbicides). Greater than 120 working days per annum is required to locate and treat patches of *A. paniculata*, preferably undertaking follow-up treatments to kill and plants missed or not killed in the first treatment round. This work was undertaken by DAFF project staff prior to the current phase of the project, but could not always be completed when optimum due to difficulties accessing the site.

The ownership of 'Batavia Downs' was transferred from the Queensland Government to traditional owners (Batavia Indigenous Corporation) during the project (with some sections co-managed with the Queensland Government for conservation purposes). This provided an opportunity to resource on-ground works to control *A. paniculata* through transfer of ownership agreements.

The long-term strategy to contain and steadily reduce the population of *A. paniculata* at 'Batavia Downs' is to transfer on-ground control activities to local operators and to assist with the generation of funding to support their efforts. Key collaborators were DATSIMA staff, responsible for the transfer of 'Batavia Downs' into the Batavia Indigenous Corporation and national parks stewardship, and field staff employed through the Batavia Indigenous Corporation to complete on-ground works.

DAFF project staff worked with DATSIMA staff to develop protocols for the containment and control of *A. paniculata* on 'Batavia Downs', and these were incorporated the transfer of ownership agreement. Approximately $20 000 per year for three years was provided by the Queensland Government to support control activities by local staff. DAFF staff committed to support the on-ground works detailed in the property transfer agreement, including the

provisions of resources to support local control and the completion of surveying and treatment activities (see (b) below).

The on-ground works were due for completion in 2014, but are currently being reviewed by DATSIMA with a view to continuing control for one more year (2014-15 growing season). This is an interim measure to maintain momentum in controlling *A. paniculata*, to reduce the threat to nearby areas of high conservation value, while alternative approaches to funding are developed.

Aeschynomene paniculata was recently found on two stations south of 'Batavia Downs' during vegetation surveys conducted prior to transfer of ownership from the Queensland Government to traditional owners (both now completed - Section 4.3.2). One property ('Strathmay') contains a large population of *A. paniculata*, whereas the other appears to have a single small patch ('Mary Valley'). The control of *A. paniculata* was included in the 'Strathmay' ownership transfer agreement (as for 'Batavia Downs') and DAFF staff completed surveying and treatment of plants (see below) during 2013-14 and undertook to purchase herbicides and safety equipment to support control of *A. paniculata* by Olkola Indigenous Rangers at 'Strathmay' during 2014-15.

(b) Assisted with implementation of the plan and monitored its progress.

Complementary activities were undertaken by DAFF project staff and the DATSIMA employed and locally supervised staff (Section 4.3.1). Local staff completed surveying and plant control in the 'core' infestation area, which contains frequent patches of *A. paniculata* and involves frequent spraying and high volumes of herbicides. DAFF project staff provided resources (quad bikes, herbicides and safety equipment) and staff familiarisation with plant identification and control techniques to support the local staff, as well as completing GPS surveys and treatment of plants in the 'outlier' areas surrounding the core infestation. DAFF staff also completed surveying and control of *A. paniculata* along the highway near the gate of a neighbouring station ('Sudleigh'). Reports on project activities by both parties were provided to DATSIMA staff for internal reporting and planning purposes.

Project staff monitored progress through inspecting areas in the 'core' infestation area to check progress by local officers and reporting to DATSIMA staff. DAFF staff also GPS-marked all new patches of *A. paniculata* and provided these to DATSIMA for mapping and reporting purposes. The number of new patches and repeat treatment (over and within seasons) of previously GPS-marked patches provided insight into the spread of *A. paniculata* and progress towards reducing plant populations. Progress was recorded within MLA Milestone Reports.

The approach of using (and, importantly, funding) local officers to treat the core infestation was highly successful. Local officers were able to treat plants during the wet season, often between rainfall events, enabling timely control of plants. Control by local officers was generally effective, and it is estimated 90+ percent of plants were killed each year. Early control of plants meant seeding was reduced compared to previous years. Plant numbers in the 'core' area noticeably declined over the three years of local control, continuing a trend observed over the last five or six years. There was also good progress in the 'outlier' areas, where hundreds of new patches were detected (surveying new areas and new patches around previous occurrences), GPS-marked and repeat treatments completed. Plant numbers at patches treated over two or three years declined markedly and some had no plants when revisited over the last two years.

DAFF project staff also supported activities at 'Strathmay' and 'Mary Valley' during 2013 and 2014. As well as assisting the development of control procedures for the ownership transfer agreement, DAFF and DATSIMA staff completed repeat surveys and treatment at

'Strathmay' along with Olkola Indigenous Rangers paid by DATSIMA. DATSIMA and DAFF staff also completed checks and treatment of plants at 'Mary Valley'. DAFF staff provided herbicides for these activities. Treatment was highly effective at both sites, although the size of the infestation at 'Strathmay' indicates further delimitation will be required over the next year to fully define the plant population.

The discovery of new incursions of *A. paniculata* on Cape York Peninsular is troubling, particularly as it is uncertain where the plants originated. Seeds may have been accidently transferred on vehicles or equipment from 'Batavia Downs'. This could explain how plants have been transferred ~200 km with no reports of any plants in between. No other occurrences of *A. paniculata* have been reported in the area or elsewhere on Cape York, despite regional land protection officers being familiar with the plant (included in the Cape York Weeds and Pest list) and vegetation surveys conducted by DATSIMA staff in properties between 'Strathmay' and 'Mary Valley' ('Artemis' and 'Dixie'). Activities which enable the detection of new infestations are a future priority for controlling *A. paniculata* on Cape York Peninsular, as are rapid responses to infestations as they are discovered. The collaborative approach to detecting and treating *A. paniculata* is considered to have been highly effective over the last few years and is recommended in future.

Objective 3. For sites containing *A. brasiliana*:

(a) Informed the relevant landholders of the intent to cease control activities, the reasons for this, and, where landholders prefer to continue control efforts, helped to develop a strategy for containment and/or progressive eradication.

The decision for project officers not to control *A. brasiliana* enabled more resources to be used for treating the less palatable legumes, particularly *A. angustissima* and *A. paniculata* (*I. schimperi* sites were mostly in regions where there were no *A. brasiliana* sites). Activities undertaken at *A. brasiliana* sites are described in Sections 4.4 (monitoring of sites and vegetation surveys) and 4.5.1 (information transfer). Project officers visited all of the locations where *A. brasiliana* was present at the end of NBP.356. Plant population characteristics and the level of grazing were recorded for each site and small populations of *A. brasiliana* were treated at a few sites visited to treat *A. paniculata*. Vegetation surveys were completed at a few sites to better understand population change and seasonal variation in grazing by livestock.

The size of the *A. brasiliana* plant populations vary considerably between sites: six are large (1000+ plants) and *A. brasiliana* is considered widely naturalised at three, possibly four. The other two large populations are considered to be contained and other populations are small and contained. *Aeschynomene brasiliana* was grazed by livestock at most sites, but mostly in the dry season when alternative sources of feed declined in value. This meant grazing was more intense (often back to crowns) in seasonally dry inland or sub-coastal areas than wetter coastal areas. *Aeschynomene brasiliana* generally did not form a monoculture (exclude grasses), but has spread at some sites. The distribution of *A. brasiliana* plants (along cattle pads, near camps and water holes) indicate movement by cattle.

Project officers discussed their activities and current approaches to the management of *A. brasiliana* with landowners, using in-site discussions where possible. Landholder opinions on the perceived impact and need to control *A. brasiliana* were also discussed during phone surveys completed in October 2014 (Section 4.6). Although completed near the end of the project, the *A. brasiliana* information sheet should improve landholder awareness.

Graziers were generally not concerned about *A. brasiliana* and were willing to continue grazing activities. One owner on a site containing a large naturalised population considered it a useful plant as an additional legume to *Stylosanthes scabra* and *Chamaecrista*

rotundifolia. No owners demanded control by project staff. It should be noted that many graziers had insufficient experience with the plant to judge whether or not it could become a weed on their properties. The change in approach towards the management of *A. brasiliana* over the course of the program (initially nominated as a weed to be controlled and later considered to be more benign as evidence of grazing was recorded) would also account for some of this uncertainty.

Changes of ownership may provide challenges for managing *A. brasiliana*. Two sites containing large populations of *A. brasiliana* have been sold over the last two years and one of these may be change again in the near future. New owners have insufficient experience with *A. brasiliana* to cast opinions on the need to control, but so far have been content with grazing the areas and observing growth and the level of grazing.

6 Impact on meat and livestock industry

6.1 Weed potential within northern Australia

The four legumes included at the start of the weed control program (1999) were included because of their perceived weed potential by researchers (Bishop, 2003). Each of the four species had persisted at a number of plant evaluation sites, and were considered relatively unpalatable to livestock compared to other pasture legumes. None were formally released as cultivars as they were seen to have relatively little value as pasture plants. Difficulty producing seed provided an additional barrier to the release of *Aeschynomene brasiliana*. As a duty of care, the Queensland Government, with assistance from staff of other agencies and co-funding from the precursor to MLA, undertook the control program which has now been running for 15 years. Project B.NBP.0706 is the fourth phase of the program.

Although control works were undertaken from the first year of the project, albeit with limited equipment and control methods still under development, a full appraisal of the weed risk of the four weeds was not undertaken until the second phase of the project (Cox, 2006). Climate match software (Bureau of Rural, 2004a, 2004b) and knowledge of rainfall and temperature distribution overseas and in Queensland was used to develop potential distribution maps for Australia (Figure 8). Although these maps do not account for changes in soil type or land management, they broadly illustrated the four legumes could grow across northern Australia given the opportunity and appropriate local conditions.

Weed risk assessments were completed by the Queensland Government for all four legumes during 2009 and 2010 (Csurhes, 2009, 2010a, 2010b; Csurhes and Navie, 2009) and can be found in the Appendices to the Final Report of B.NBP.0356 (Cox, 2010b). Summary sections of these weed risk assessments can be found in this report in Appendix 9.24. In brief:

- *Acaciella angustissima* was considered to have 'clear potential to become a widespread and abundant pest over substantial areas of rangeland and deciduous vine scrubs in the dry tropics extending south into sub-tropical areas'
- *Aeschynomene paniculata* has the 'potential to become widespread and abundant over substantial areas of North Queensland's tropical open eucalypt woodlands, possibly replacing more valuable pasture species and replacing native understorey plants'.
- *Aeschynomene brasiliana '*appears well adapted to the seasonally dry tropics of north Queensland. Within this climate zone, it is perhaps best adapted to open, tropical woodland. If allowed to spread, *A. brasiliana* has the potential to become a widespread plant over much of north Queensland's open tropical woodlands'.
- *Indigofera schimperi* is listed as a minor weed of arable fields in eastern Ethiopia. Field observation in Queensland suggests that it could become a low-impact but persistent weed.

The four species have consistently proven to be persistent in the absence of control (although some are growing weakly under some environments) and prolific producers of long-lived seeds (through hardseed dormancy). For example, it took 13 years of absolute control to finally have no plants emerging at one *I. schimperi* site in southern Queensland. Although certain management (fire, cultivation) and more frequent rainfall appears to accelerate the erosion of soil-seed banks, it is reasonable to expect new plants emerging five to 10 years after the last plant has seeded.

Whereas the above features have remained consistent over the life of the program, there has been mounting evidence that *A. brasiliana* is more palatable than the other three legumes and it may not be as much of a concern as once thought. Differences in palatability between the legumes were noted as early as 2006. The following is an excerpt from the 2006 Final Report:

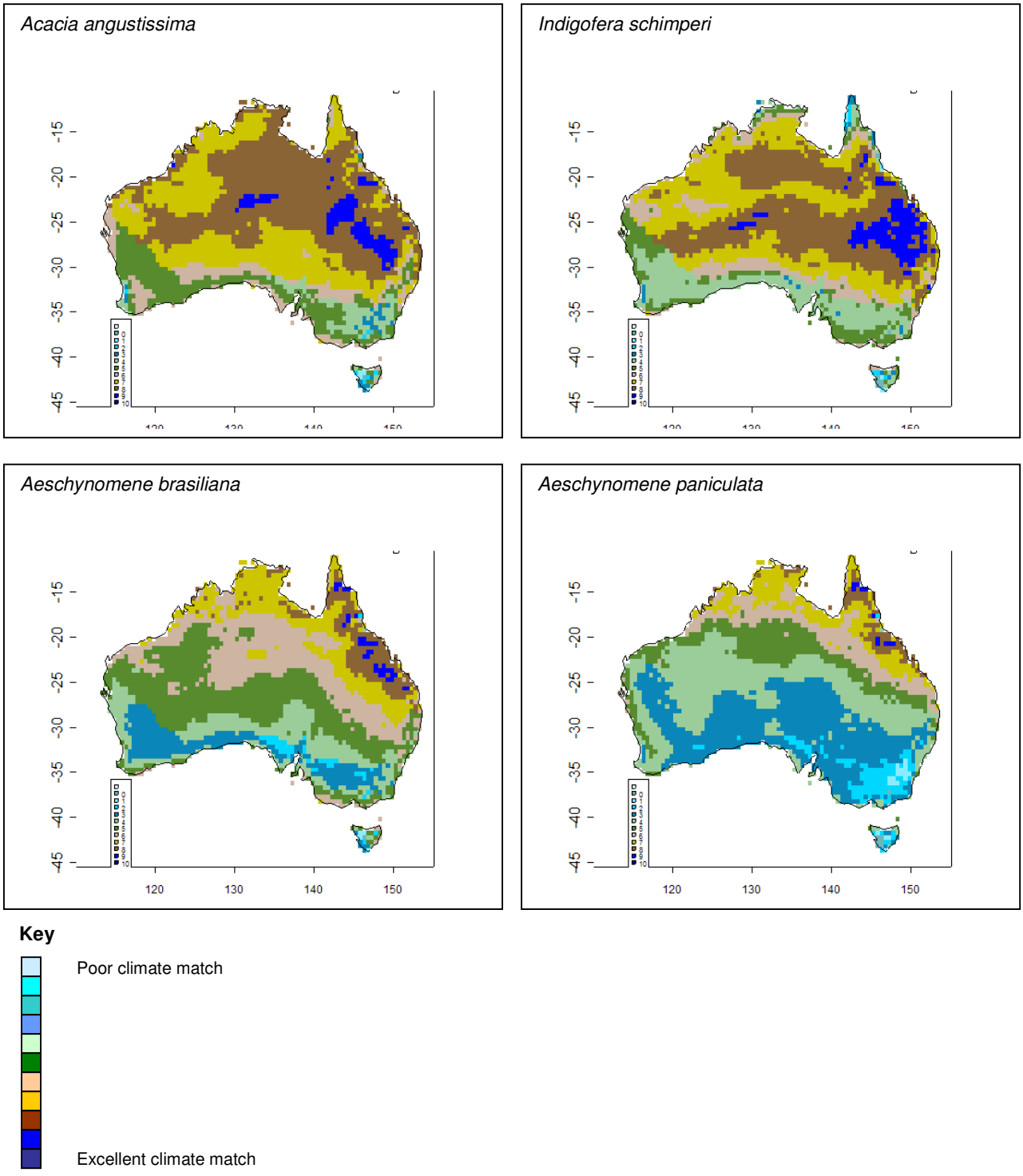

Figure 8. Potential adaptive range of the target legumes in Australia based on climate-match analysis (Cox, 2006).

Low acceptability to grazing or browsing animals
The four target plants all have moderate-low to low palatability, and therefore limited application as a feed resource for livestock. Each legume is generally not eaten during the growing season when more palatable companion plants are eaten. This allows the legume to dominate, particularly under high stocking rates, sometimes forming mono-specific stands. *Acacia angustissima, A. paniculata* and *I. schimperi* are rarely eaten during the dry season, when seeding usually occurs. This means that seed production can occur unabated in most situations. *Aeschynomene brasiliana*, however, was eaten during the dry season at some sites, effectively suppressing seeding. However, high stocking rates are required making it difficult to manage the balance of grass and legume on extensive grazing properties.

Observations over Phase 3 of the program supported grazing of *A. brasiliana* during the dry season when alternative feed sources were declining in value (similar to how *Stylosanthes scabra* is eaten). To better focus project resources on the less palatable species, it was decided to prioritise control on *A. angustissima*, *A. paniculata* and *I. schimperi* in B.NBP.0706. Better records on grazing and vegetation surveys completed over the last three years support the view that *A. brasiliana* is eaten in the dry season and may even be of some (minor) benefit to graziers in the seasonally dry areas in north Queensland. However, the recent studies also indicate *A. brasiliana* is unlikely to be well eaten in areas where alternative feed remains of high quality throughout the year (wet, coastal areas).

Although not necessarily impacting weed potential, it should be noted that the Queensland Government is currently reviewing official weed classification through a new Queensland Biosecurity Act. It is uncertain how this will impact on landholder obligations for control of the four plants included in this project: currently there is only a legal requirement for landholders to manage *A. angustissima,* as a Class 1 Declared Plant in Queensland, as the others have no formal weed status. It seems likely that there will remain a legal requirement to manage *A. angustissima*, as a 'Restricted Plant' in Queensland. However, the status of the other three species is less certain. Along with many other plants, they may be considered to be 'Biosecurity Matter'. This means if a person ought reasonably to know that the plant poses a biosecurity risk that person has an obligation to take all reasonable and practical measures to minimise the biosecurity risk. Under this system the appropriate response is in proportion to the perceived risk.

6.2 Potential impact on the Beef industry

The overarching rationale for the control program is to restrict the distribution of persistent plants which could potentially become contaminants of north Australian grasslands used for beef production, thereby:

1. Maintaining the productivity of grazing lands through preventing unpalatable plants dominating pastures.
2. Preventing expenditure by landholders to control large infestations should this be deemed attainable and economically viable.

The prevention of introduced plants dominating grasslands clearly also has benefits for conservation and social (e.g. cultural) reasons, but the following analysis is based only on economic considerations.

The original aim of the program was for species eradication. Although eradication is considered feasible at many sites (and appears to have been achieved at many), this is regarded as an unrealistic short-term goal on a species level due to the size of some of the infestations and the presence of long-lived seed in soil. The concept used in recent phases of the program has been to use early intervention control of plants not yet widely naturalised to reduce long-term costs (Figure 9).

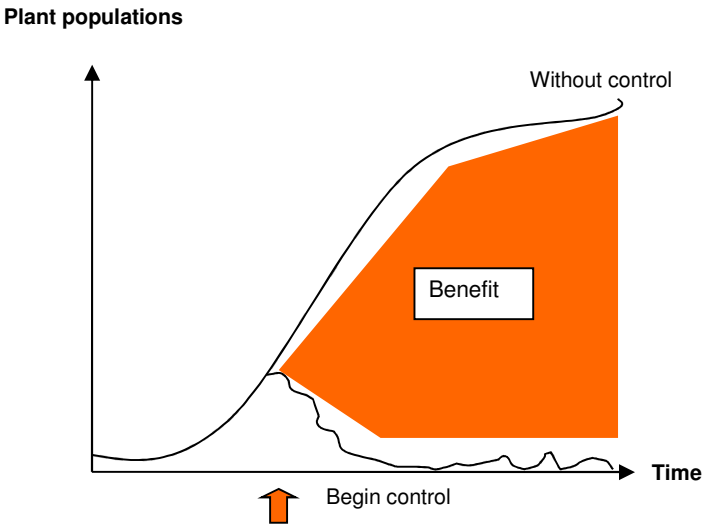

Figure 9. Concept diagram of mitigating the impact of a new invasive plant.

External reviews of the *economic* benefits of containing the target plants are limited. In an exercise to determine plants with significant economic impact for Australia the Bureau for Rural Sciences found the costs of not controlling the *A paniculata* could conservatively be estimated at $45m per annum to the Beef Industry or a total cost of $352m (Brinkley and Bomford, 2002; Cunningham *et al*. 2003). Experience from this program, particularly on Cape York Peninsular, suggests *A. paniculata* can indeed rapidly spread and increase in population if not controlled. Approximately $80 000 has been spent by the Queensland Government to employ officers to treat plants on 'Batavia Downs' (in the last three years) and 'Strathmay' (last year). This does not include DATSIMA and DAFF officer time spent surveying for, and controlling, plants. Similar expenditure will be required in the next few years to manage these sites, particularly if local officers are to begin to control plants in outlier areas of 'Batavia Downs' and to complete delimitation and treatment at 'Strathmay'. This experience indicates pre-emptive control (if possible) would be highly beneficial, but will require a considerable investment. *Aeschynomene paniculata* is considered a priority species for containment and control.

Although detailed analyses have not been conducted on the three other legumes, it seems reasonable to expect that they would have some potential economic impact should they eventually become widely naturalised. Weed risk assessment information on adaptation and growth habit and plant palatability indicate:

- *Acaciella angustissima* – likely to have a lesser short-term effect than *A. paniculata* because it is less mobile and easier to control before seeding. However, blade-ploughing of the dense thicket at 'Lansdown 2' indicates there is considerable cost if allowed to become dominant. Currently small, contained populations so a relatively low cost of investment. High priority.
- *Aeschynomene brasiliana* – has proven to be mobile, particularly in north Queensland where it appears best adapted. However, *A. brasiliana* is also eaten by cattle and is considered but some to be a potentially useful plant in seasonally dry areas (if of minor benefit as a substitute to other plants). Likely naturalised in some areas, so beyond control without very large investments (even then containment would be doubtful). Low priority.

- *Indigofera schimperi* – of moderate to low weed potential, but persistent and unpalatable in grasslands. Small plant populations at most sites and eradicated (or close to) at many. Moderate priority.

By October 2014, *A. angustissima* and *I. schimperi* were all restricted to their original control areas or areas immediately adjacent to these. The same applied to most *A. paniculata* and *A. brasiliana* sites. There was no impact on the productivity of grazing lands associated with these sites. Similarly, although some of the *A. brasiliana* sites contain large wide spread populations, seasonal grazing has resulted in no known cost to producers. The *A. paniculata* infestations on Cape York Peninsular, although spread across thousands of hectares, have had no appreciable impact on the productivity (potential of the feedbase to support cattle) of the beef enterprise at 'Batavia Downs'. However, management has imparted considerable cost in time to the managers of 'Batavia Downs' and encouraged investments in fencing new areas free of *A. paniculata*. There have also been considerable financial and time costs to Queensland Government staff.

There has been a cost to the Beef Industry, through the use of levied funds, to complete the four phases of the program. Approximately $0.63m has been invested by MLA for salary and operating costs over the program, with a significant amount invested in-kind by the Queensland Government (salary and salary on-costs) and lesser in-kind contributions by CSIRO and James Cook University. Overall, some $2m has been invested to date over 15 years. The potential cost of the three least palatable weeds, should they become widely naturalised, could be conservatively estimated at $500m ($350m for *A. paniculata* as above and $150m for *A. angustissima* and *I. schimperi*). Conservatively assuming that the plant impact was only 10 percent of the calculated cost to production in the potentially affected area (i.e. 10 percent of $500m), the Benefit/Cost ratio calculated could approximate $25m.

In an external review of the project commissioned by MLA in 2006 (MLA, 2006) considerably lower economic costs should the target plants become widely naturalised were calculated, with the greatest potential impact being *A. paniculata* ($25m pa) followed by *A. angustissiuma* ($6m) and *A. brasiliana* and *I. schimperi* ($1m each) (Table 13). High returns of investment for control of the target plants were calculated over 30 years using a range of scenarios (Table 14). The benefit/cost ratio for works undertaken calculated to be ~$10 with a discount rate of 5 percent.

Overall, there appears to be value in mitigating the impact of the target legumes through continued works, particularly for the unpalatable species. Based on our experience to date and the economic analyses above, it seems sensible to place priority on the control of *A. paniculata* and *A. angustissima*, with lesser emphasis on *I. schimperi* and *A. brasiliana*.

Table 13. Potential economic costs of the four target legumes (Meat and Livestock Australia internally commissioned report 2006).

Species	Potential Economic (industry) Impact	Assumed Likely Economic Impact	Time to Likely Economic Impact
Aeschynomene paniculata	$25 m per annum in foregone production and control costs	$5 m per annum	20 years from break out
Aeschyomene brasiliana	$1 m per annum	$0.2 m per annum	20 year from break out
Acacia Angustissima	$6 m per annum based on prickly acacia costs	$1.2 m per annum	20 years from break out
Indigofera schimperi	$1 m per annum	$0.2 m per annum	20 years from break out

Table 14. Potential costs and benefits of undertaking the control of the four target plants as at 2006 (Meat and Livestock Australia internally commissioned report 2006). Values were calculated in 2006 dollars over 30 years from 1999/2000 with a discount rate of 5%.

Criterion	All Benefits and All Investment	MLA Benefits and MLA Costs in Project NBP.327	MLA Benefits and MLA Costs for Investment in NAP.225 and NBP.327
Present value of benefits ($m)	16.43	1.57	2.73
Present value of costs ($m)	1.00	0.15	0.28
Net present value ($m)	15.44	1.42	2.45
Benefit-cost ratio	16.5 to 1	10.1 to 1	9.7 to 1
Internal rate of return (%)	28.4	25.5	21.4

7 Conclusions and recommendations

7.1 Conclusions

7.1.1 Weed potential

1. The size and persistence of *Aeschynomene paniculata* infestations on Cape York Peninsular and unpalatability to livestock demonstrate this species has high weed potential and support independent analyses, which identify high potential costs to the beef industry should it not be controlled. There is a good opportunity to contain and deplete populations at most sites, but two sites under indigenous ownership on Cape York Peninsular will require considerable resources to contain.
2. *Acaciella angustissima*, also unpalatable to livestock, has significant, but lesser, weed potential because it is less mobile. However, control costs have proven high once naturalised. There is good potential to contain *A. angustissima* at all sites and eradicate plants in the short to mid- term.
3. *Indigofera schimperi* is a minor, if persistent, unpalatable contaminant of pastures and cropping areas. However, it is perceived by many landowners as a plant worth removing and there has been excellent progress containing, reducing and eliminating plant populations to date.
4. *Aeschynomene brasiliana* is considered to have less weed potential than the other species because of its moderate palatability to livestock. It is eaten in a similar way to other pasture legumes in areas with a strong dry season component, although it is grazed less intensively in areas where alternative feed quality remains high. *Aeschynomene brasiliana* is considered widely naturalised at some sites in north Queensland where it is grazed.

7.1.2 Efficacy of containment and control of seeding

1. Plant populations have been restricted to their nominated control areas and plant populations continue to decline at most sites. Progress has been best at sites with smaller populations and there have been no new plants detected at some of these sites over the last two years.
2. *Aeschynomene paniculata* was, however, found at two new sites on Cape York Peninsular and plants have spread into surrounding areas, including the original control areas at one *I. schimperi* and one *A. angustissima* site.
3. The accumulation of mature seed into soil was prevented at most sites with smaller populations (<100 plants) over the three years of Phase 4 of the program. Complete control of seeding was not achieved at most sites containing large, widespread populations as it was not possible to detect and treat all plants.

7.1.3 Transfer of control to landholders

1. There has been good progress towards better involving landholders in the control of *A. angustissima*, *A. paniculata* and *I. schimperi* over the last few years. A few sites are completely under landholder control, and landholders are contributing to control at half of the sites. Landholder activities include: manual removal of plants, applying herbicides, cultivating and slashing or grazing to facilitate easier control.
2. There has been considerable landholder and stakeholder (Regional Councils and Queensland Government Departments) cooperation at some sites containing large populations, particularly to control a large infestation of *A. angustissima* site near Townsville and the large infestations of *A. paniculata* on Cape York Peninsular.
3. Control of plants by project officers has been required to: support landholders in the satisfactory control of plants; treat sites where landowners are not controlling plants

(e.g. following changes of ownership); and treat plants at sites under the control of project staff agencies.

4. On-site discussions and telephone interviews with landowners indicate most are willing to contribute to future control of *A. angustissima*, *A. paniculata* and *I. schimperi*, but seek assistance from project staff to identify plants, advise on management and undertake control of plants. A few landowners believe project staff should undertake all control as a 'duty of care'.
5. Control of *A. brasiliana* by project officers was not sought in this phase of the project. Landowners have generally accepted this decision, although some landowners (particularly new owners) are reserving judgement about the weed potential or usefulness of the plant to their operations.

7.1.4 Required future action

6. *Aeschynomene paniculata* and to a lesser degree *A. angustissima* appear to pose significant costs to the beef industry should they not be contained. Small populations of these species in areas valuable to the beef industry suggests investment in control, aiming at absolute containment and site eradication, is possible. Large areas of *A. paniculata* on Cape York Peninsular would impact on a less valuable sector of the beef industry, but there are significant conservation and cultural considerations. Activities which support detection and landowner control should be promoted.
7. *Indigofera schimperi*, of lesser weed threat to the beef industry but potentially important on a property level, should be controlled if landholders are concerned. Activities which assist landowners to conduct control are preferable to control by project officers.
8. *Aeschynomene brasiliana*, naturalised in some areas, appears to have less potential to have a negative impact on the beef industry because it is eaten by livestock. Activities which monitor plant populations and grazing, and thereby assist land owner decision making, would be a suitable precaution against falsely rejecting a weed in the absence of control.

7.2 Recommendations

7.2.1 Prioritisation of species and activities at sites south of Cape York Peninsular

1. When considering any future activity, place priority of control as follows (from highest to lowest priority): *Aeschynomene paniculata*, *Acaciella angustissima*, *Indigofera schimperi* and *Aeschynomene brasiliana*.
2. Review the legal status and obligations of landholders to manage the four legumes under the upcoming Queensland Biosecurity Act. Use this information when considering the development of future project activities.
3. Continue to promote landholder control of the target plants, particularly *A. paniculata*, *A. angustissima* and *I. schimperi*. Support would include regular visits to monitor progress and assist with plant identification, the development of treatment options and (where required) the supply of herbicides. Project officers should only treat plants as an interim measure to support long-term local control.
4. For sites containing *A. brasiliana*, project officers visit sites less frequently (once per year) to discuss management on site and monitor plant populations and grazing.
5. For all species, but with priority on the unpalatable legumes, develop a decision-making framework to better assist landowners to determine critical cues of actions and discuss their implementation with landowners.

7.2.2 Control of *Aeschynomene paniculata* on Cape York Peninsular

6. Provided DATSIMA fund plant eradication at 'Batavia Downs' during 2014-15 project staff continue to support local control efforts i.e. supplying or leasing equipment and herbicides; completing surveying and treating plants in the outlier areas (2014-15).
7. Project staff investigate alternative funding arrangements to continue control of *A. paniculata* at 'Batavia Downs'. Obvious collaborators would be DATSIMA (and QPWS), the traditional owners, (potentially) indigenous ranger groups and MLA ((2014-15). DAFF staff would contribute to this project, but the emphasis will be on transferring management of patches in outlier areas into local control.
8. Contribute to the delimitation and control of *A. paniculata* on 'Strathmay', with project staff assisting Olkola indigenous rangers to complete surveying and control of *A. paniculata* on property (approximately $4000 per annum to supply equipment and herbicides plus 10 days of officer time on-site)(until June 2016).
9. Project staff work with DATSIMA staff and traditional owners to monitor and treat the one small patch of *A. paniculata* at 'Mary Valley' and continue checks at 'Sudleigh' (2014-2017).

Finally, the program has provided excellent lessons and technical insight into the pre-emptive management of perennial legumes in extensive grassland situations in northern Australia. These should be incorporated into the development of principles and decision-making guidelines for other species, and be used to better understand cues which motivate control by landholders.

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9 Appendices

9.1 A history of fodder plant evaluation in Queensland.

Prior to 1987, pasture species evaluation in northern Australia focussed primarily on local needs. This approach did not result in widely applicable outcomes. To extend the impact of evaluation research, it was recognised that there needed to be a broader focus to the work, and a more structured approach adopted. In a process initiated through the Northern Australian Pasture Plant Evaluation Committee (NAPPEC), a series of collaborative projects was undertaken, each with a different end in view. There have been three major species evaluation research activities undertaken between 1987 and 1998:

- Coordinated pasture evaluation in northern Australia (COPE) – Project DAQ.081
- Backup legumes for stylos (BULS) – Project DAQ.083
- Legumes for Clay Soils (LCS) - Project DAQ.086

COPE (1986 to 1995) and LCS (1992 to 1996) were collaborative projects between DPI and CSIRO. NTDPIF (now an agency within DBIRD in NT) collaborated with DPI and CSIRO on the BULS project (1992to 1998). COPE, was a screening project, initiated to assess the wide range of grass and legume genetic material then held in the Australian Tropical Forages Genetic Resource Centre, a collection comprising some 17 000 legume and 11 000 grass accessions (Hacker 1997). Many of these accessions had never been assessed in field trials. This project was the precursor of the other two projects.

BULS, as the name implies, sought to identify alternative species to the various *Stylosanthes* spp available at the time. Experience with this genus had shown that resistance to anthracnose disease could break down as new strains of the organism (*Colletotrichum gloeosporioides* developed, sometimes with near disastrous consequences, as happened with *S. humilis.* The project further aimed to assess the animal production potential and nutrient responsiveness of some elite species relative to *Stylosanthes* in the area. LCS sought to select legume species to colonise the large areas of cracking clay soils in northern Australia, as the various grass pastures in the area were losing productivity through nitrogen rundown. Other activities within the project aimed to elucidate agronomic and production characteristics of elite accessions.

Selection of species for evaluation

Selection of germplasm for inclusion in the COPE program was based on previous knowledge of certain species, and the intention to draw material of diverse genetic makeup from a range of environments. Selection of intra-generic diversity was achieved using the results from 16 characterisation projects in which certain genera and species were divided into morphological and agronomic groups. Geographic diversity was achieved using the detailed passport data recorded for each accession in the collection. Species or accessions that were known or suspected to be toxic or unpalatable, or to possess thorns, were not considered for inclusion in the program. Entries in the BULS project were selected on the basis of merit in the COPE series of experiments, as well as accessions that had shown superiority in previous work. Selection of entries for LCS presented some difficulty since few warm season legumes grow naturally on heavy clay soils. They are largely found on lighter textured, less fertile soils. Entries were therefore limited to those species endemic to or known to perform well on heavy clays. This included the genus, *Desmanthus*, and species such as *Indigofera schimperii, Clitoria ternatea, Vigna trilobata* and *Macroptilium bracteatum*. In a number of cases, this reflected adaptation to an alkaline environment (typical of many heavy clay soils) rather than adaptation to clay soils *per sé.*

Selection of evaluation sites

The COPE program was developed to enable evaluation of accessions at representative sites throughout Queensland. Sites were selected to take account of variation in climate, soils and vegetation, with a focus on those areas with the greatest potential for economic impact – notably the speargrass and *Bothriochloa-Aristida* grasslands. While most sites (12) were situated in these sub-humid environments of the State, four were chosen in the humid zones of north and south Queensland. Average rainfall at the sites ranged from about 550 mm per year near Charters Towers to 3550 mm per year at Silkwood south of Innisfail. Since the BULS project was instituted to seek alternative species to stylos, it was important to select sites on the basis of their dependence for pasture improvement on the genus, *Stylosanthes*. A total of 55 legumes was sown in a network of 27 sites on soils suitable for stylos in Queensland and the Northern Territory.

The sites in Queensland were located in coastal and sub-coastal districts between Gympie and Mt Garnet, and in the Northern Territory, at Katherine and Daly Waters. Another 5 sites were sown to selected legumes to record liveweight gain, and phosphorus response of 9 elite legumes assessed at a further 3 sites. Average rainfall varied from about 650 mm at Nebo, Charters Towers and Daly Waters to 1500 mm near Sarina. The LCS project was conducted over many research station and farm sites in southern and central Queensland, at Gayndah, Mundubbera, Theodore, Biloela, Wandoan, Middlemount, and Emerald, all in the sub-humid zone, and all on dark clay soils in the downs and brigalow regions of the State.

Evaluation procedure (design, methodology, data recorded)

The COPE project was carried out in two phases, COPE I (CS.054/DAQ.053, 1987 – 91) and COPE II (CS.185/DAQ.081, 1992 – 95). The design of the project aimed at enhancing the introduction, quarantining, initial seed increase, and finally the evaluation of tropical grass and legume germplasm over a representative set of experimental sites. Both phases were conducted using a randomised block design with two replications. In COPE I, entries were sown in single 4 m rows to facilitate ease of observation, and measurement of spread and persistence. Observations on flowering time, seed set and vigour were also recorded. Following a review in 1990, it was determined that entries should be sown in mini-swards, 4 x 1 m2, and that fertiliser response should be assessed. Accordingly, in COPE II one replicate was fertilised at recommended rates and the other treated as a control; whereas, in COPE I, all plots were fertilised in accordance with local recommendations.

With a total of some 1100 accessions evaluated over the life of the project, and at least annual measurements taken of development and performance of each entry, enormous data sets were generated. A summary of results was entered on QPASTURES, and researchers with a responsibility for individual genera distilled the data further and collated into the form presented in “Final Report of MRC Projects CS054/185 and DAQ053/081, Development of new legumes and grasses for the cattle industry of Northern Australia” (1996).

In the species evaluation component of the BULS project, larger plots were used in order to give a better assessment of animal preferences. Micro-plots as used in COPE can give a misrepresentation of palatability ratings. Seed was mostly broadcast onto the surface of a disturbed seedbed at 3 to 5 kg/ha. A minimum germination of around 30% was attempted, and all legumes were inoculated with the appropriate rhizobium. Pasture presentation yield and composition were recorded towards the end of each growing season using “BOTANAL” (Tothill *et al.* 1992). Legume population and other observations (palatability, disease, etc.) were also recorded during BOTANAL assessments.

All sites were grazed by cattle following the first winter, either in conjunction with an adjacent (small) paddock or with weaner steers locked on the site. In the grazing evaluation, the aim was to compare over a number of sites the liveweight gain from a grazable area of a promising legume in one paddock with a similar area of a standard cultivar in another. Pasture presentation yield and composition were recorded towards the end of the wet

season using BOTANAL, as well as legume populations. At other sites, phosphorus response was measured by destructive sampling of small plots in a randomised block layout. A complete dressing of other nutrients was applied so as not to confound P responses.

The LCS on-farm evaluation trials measured establishment, production and persistence and demonstrated the value of commercial and near-commercial legumes for use in grazing and ley pastures on clay soils. A range of legumes including known annual or short term and perennial cultivars and promising accessions was sown in large plots on commercial properties at 7 sites in 1994 and at 6 sites in 1995. The range of legumes was expanded in 1995. Of these sites, 5 from 1994 sowings and 5 from 1995 sowings were successfully established and legume density and yield have been recorded. One site was resown in 1996. Soil types are either black earths on open downs country or clay soils cleared of brigalow. Legumes were sown onto cultivated seedbeds on land used for grain or forage cropping except for 2 of the sites sown in 1994. One of these was blade-ploughed and one was sown on a downs soil without cultivation. Both failed to establish. At the other sites seed was sown onto the surface and rolled using press wheels. Sub-soil moisture varied from good to poor. Seed of Queensland bluegrass (*Dichanthium sericeum)* was oversown across all the legume plots at 1 kg/ ha, except at Kookaburra where bambatsi panic (*Panicum coloratum)* was used. All sites have been grazed, generally at the end of the summer growing season, but the intensity and length of grazing has varied because the areas are situated in paddocks used for cropping.

In the LCS small-plot trials, one hundred and fifty two legume accessions were planted over three years (1992-1995) at three sites (Narayen, Brigalow and Emerald Research Stations). Selected groups of legumes were sometimes grown with and without a sown grass. The remainder were sown with a grass adapted to the local area. Measurements at each site included annual plant density and yield, with observations on flowering and seed production. Survival of marked plants was measured on some accessions. Seventeen accessions of annual medics were established during the 1993 winter at three sites (Narayen, Emerald and Biloela). Irrigation was used to enhance emergence and growth in the establishment year, and to enable the all-important seed set, but was not used thereafter.

Data storage

QPASTURES is a QDPI computer database of pasture species evaluation trials conducted by DPI (largely) around Queensland. Some of its records go back 100 years but most begin about 1940 and fully detailed trials only exist currently from about 1965. However, the intention is to continually expand the content as resources allow so that the database contains a fairly comprehensive record of the forage species evaluation trials, and their results, that have been undertaken in Qld. The research results are supported by a sizable bibliography relating to the plants involved and official publications relating to the research and the formally released cultivars.

Cultivar release

Plant release is the process of transferring an elite variety from research to commerce. Related to this, but not an integral part of it, is cultivar registration. This is simply the process of describing and cataloguing that elite variety, at or about the time of release. Before 1987, new cultivars were released publicly. A Seed Increase Committee (SIC) appointed by and from the Queensland Herbage Plant Liaison Committee, oversaw the initial phase of release of each new cultivar in Queensland. The SIC comprising four members, one each from Department of Primary Industries, the Seed Industry Association, and the Queensland Seed Producers' Association, together with a representative of one of the other bodies on QHPLC, ensured that adequate supplies of seed were made available to seed growers. This was done in association with growers. The SIC, having determined the amount of seed required, approached prospective growers, who entered into contracts to produce seed at a price determined by the SIC. The SIC was disbanded when members felt confident that the new

variety had every chance of being successfully absorbed into commerce. This early approach accommodated a large volume market, the initial seed increase being spread over a number of seed producers. At that stage, there was less emphasis on public sector accountability than there is now, and methods for selecting growers may not have stood today's critical scrutiny.

In the early 1990s, a new system of release emerged via the Plant Varieties Rights Act and subsequently the Plant Breeders Rights Act, by virtue of which, new varieties became the property of the discoverer. Proprietary rights to a selected variety could be granted under licence to the commercial sector by the organisation developing the new variety. This provided an extremely transparent, although expensive means of plant release. However, in 1998, the Plant Breeders Rights Office, in response to questions raised by farmers' rights groups, Rural Advancement Foundation International (RAFI) and Heritage Seed Curators Association (HSCA), about the propriety of the pasture plant commercialisation system in tropical Australia, chose to interpret the PBR Act more narrowly, thus excluding most pasture plant releases from eligibility for PBR protection. The fact that their criticisms were flawed and verging on libel did not deter RAFI and HSCA. None of the organisations accused of "Biopiracy" chose to challenge the allegations. The PBRO reacted by not accepting any variety that could not be shown to be different from the parents. Since most of our grasses are apomictic and most of our legumes cleistogamous, there was unlikely to be much, if any, variation in the populations of wild species that we are dealing with, and hence little chance of even selecting from within a population. This process may have bestowed eligibility, but our conventional approach of selecting from a range of wild type populations was no longer seen by the PBRO as "breeding".

It has now become necessary to revisit the release process to accommodate changes in the various organisational structures together with the need for transparency and accountability. This has become further complicated by the disbandment of QHPLC and NAPPEC at the 2002 combined meeting. It was agreed that the two organisations should merge, and that an alternative release process be developed.

9.2 Executive summary of the first phase of the eradication program (Bishop, 2003).

Executive Summary

The Managing Old (discontinued) Plant Evaluation Sites (MOPES) project has significantly contributed to a more responsible approach to the practices and processes associated with introduction, evaluation, release and development of new forage plant cultivars for the grazing industries in Northern Australia. MOPES was largely successful in achieving it's objectives. Evaluation sites throughout Queensland were thoroughly monitored with the information converted to database, priority "target" plants were nominated after consultation with many stakeholders and the target plants are being contained and eradicated. However, it is recommended that "target" plant control activity continue for a further three or more years to complete the task started by MOPES.

The MOPES project is one of a number of responses to a growing community awareness of "environmental weed" issues. Other responses include "best practice" and "duty of care" codes, developed by a number of industries along with changes to Government legislation, as in the Australian Quarantine Inspection Service (AQIS) Weed Risk Assessment (WRA) system proclaimed in 1998.

In the past 40 years the sown pasture industry has contributed significantly to the development, viability and sustainability of the various animal industries in northern Australia. The demand for persistent, productive and nutritious grasses and legumes, to feed our introduced grazing animals, has successfully been met by research agencies. A very wide choice of cultivars, to meet a wide range of climate, soil and grazing situations is now available to land managers.

This increasing demand for new and better adapted forage plant cultivars for northern Australia during the period 1986 to 2000, to allow animal products to better meet market specifications, resulted in a major coordinated plant evaluation program involving Meat and Livestock Australia (MLA), land owners, QDPI and CSIRO. Over 2000 introduced plants were evaluated in a network of sites on Research Stations and landholder properties across northern Australia. Over this period the program contributed to the release of 21 legume and 18 grass cultivars. However a number of well adapted potential new legume cultivars were withheld from release due to low palatability to stock and little or no live weight gain data to assess their contribution to animal production. These well adapted plants with low palatability to stock were targeted for containment and eradication under the MOPES project.

Target plants and characteristics contributing to their listing:

Acacia angustissima / boliviana: Well adapted to sub-humid zone, low palatability (rated 1 out of 3, although leaf is browsed in sub-humid zones), suckering from roots when disturbed, free seeding with seed of high potential longevity, seedling establishment and spread.

Indigofera schimperi: Well adapted to sub-humid zone, low palatability (1 out of 3, although leaf is browsed in sub-humid zones), suckering from roots when disturbed, prolific seeding, seedling establishment and spread.

Aeschynomene paniculate: Well adapted to humid zone, low palatability (1 out of 3, although tip grazed at some sites), low leaf/stem ratio lessens effectiveness of herbicide control, free seeding.

Aeschynomene brasiliana: Well adapter to sub-humid zone (second to Seca stylo in Backup Legumes for Stylos project), leaves stems and pods sometimes sticky, moderate palatability (2 out of 3) but no live weight gain data available.

Success in achieving project objectives

QPASTURES, a forage plant evaluation database, was used to identify sites where target plants were sown. Over 100 discontinued evaluation sites were identified, 22 on Research Stations and the remainder on landholder properties. These sites were inspected, assessed and a containment and eradication plan initiated where target plants existed. The QPASTURES data base is a good indicator of where target plants were sown in Queensland but there is still a lot of data (detail of property sites, species/accession lists and performance) to be entered into this data base. This project provided extra impetus to modernise the database environment with a web browser user interface which is now available to all DPI staff at their desks. A link to it exists automatically from the DPI intranet homepage (Knowledge Base/Systems/Qpastures). Thus its content is freely available to all staff and registered plant evaluation officers.

This project developed, implemented, assessed and documented the monitoring, containment and eradication strategies used on target plants. This plan incorporated one, several or all of the following strategies; fencing, grazing management, fire, over-sowing a competitive grass, nitrogen fertiliser application, herbicide application and hand chipping. Although good success has been achieved in the past three years, to achieve full success at all sites, the containment and eradication plan needs to be implemented for another three to four years.

This project has greatly increased discussion and planning between landholders and RD&E agencies on the potential risk of trial species/accessions "escaping" from evaluation sites and becoming environmental weeds. The project activities are helping to develop a culture of environmental responsibility amongst industry and agency people with regard to evaluation of introduced forage plants.

This project has significantly reduced the risk of future environmental weeds arising from the major network of introduced forage plant evaluation programs conducted by DPI and CSIRO during the 1980's to late 1990's.

Total eradication of legume target plants has not yet been achieved where soil seed reserves have occurred due to past seeding events. However this project has successfully contained and reduced plant and seedling populations. Few mature plants now remain at priority sites but where target plants have seeded for several to six or more years, accumulated soil seed reserves could be an ongoing source of seedlings. However several such sites where the containment/eradication plan has been implemented for six to eight years, target plant frequencies have dropped from 90 to 100% down to 1 to 10%.

A separate site management manual will not be prepared as an outcome of this project. However the Northern Australia Pasture Plant Evaluation Committee has developed a Code of Practice to guide pasture scientists and landholders in an ethical and environmentally responsible approach to the evaluation and release of tropical pasture plants. The MOPES project team has been working closely with the North Australian Pasture Plant Evaluation Committee to develop this code (presented in appendix 10.8 of the report).

Recommendations

1. Management of old plant evaluation sites (monitoring, containment and eradication activities) needs to continue for another 3 to 4 years, to build on the progress made during this initial three year project. A draft new project proposal is presented in appendix 10.7.
2. Strong links need to be made with the Department of Natural Resources and Mine's (NR&M) Strategic Weed Eradication and Education Program (SWEEP) team in any ongoing project, plus continuing links with the other participating inter-agency groups.
3. Develop under graduate and post graduate research projects with Universities and Colleges to study specific environmental weed issues, as in ecological and life cycle studies and control methods.
4. Future forage plant evaluation and cultivar development programs need to follow the new NAPPEC code of practice as outlined in appendix 10.8 of this report. Short term funding for short-term evaluation projects, which specify the number of cultivars to be released, increases the risk of premature release prior to appropriate assessment of palatability and weed potential.
5. Up-to-date information packages on the role, production and sustainable grazing management benefits provided by currently available pasture cultivars, need to be develop. The current emphasis on potential environmental weeds should not be allowed to threaten or lessen the very positive benefits that introduced sown forage plant cultivars provide to grazing industries and to the environment in northern Australia.
6. Positive case studies on the economic and environmental benefits from integrating sown pastures into whole enterprise grazing/cropping production systems, need to be prepared by land holders, land managers and DPI and published in all media forms and at forum events.

9.3 Executive summary of the second phase of the eradication program (Cox, 2006).

Executive Summary

Project NBP.327 is the second phase of a six-year plant eradication program begun during 1999. The eradication program was developed following concerns by researchers and industry representatives that some of the many grasses and legumes evaluated in Beef Industry and state and federal plant evaluation programs may become significant weeds of north Australian grasslands. These concerns appeared justified as, later, the potential cost, in terms of lost beef production and costs of plant eradication, of one of these plants (*Aeschynomene paniculata*) was estimated at over $350 M (Brinkley and Bomford, 2002). The eradication program targeted control of this species and three other legumes considered to have high weed potential.

Previous plant evaluation and eradication

The plant evaluation programs, undertaken between 1986 and 1998, were of a broad scale, covering a wide range of land-classes in Queensland and a wide range of species (mostly exotic) and ecotypes within these species (over 2000 accessions). Overall, the programs are considered to have been successful: characterisation of the tropical forages collection has enabled researchers to identify useful species and ecotypes, some later being commercially released, and to identify species or ecotypes of little potential future value, contributing to the rationalisation of the tropical forages collection. However, the programs involved the establishment, effectively biological release, of new plants at sites across Queensland on a variety of scales (small plots to 40 ha grazing trials). In keeping with responsible practice, the proponents of the evaluation programs sought to undertake actions to prevent any undesirable plants becoming widely naturalised.

During Phase I of the eradication program, NAP3.225 (1999-2002), all species established at evaluation sites were appraised for weed potential. Four perennial legumes were identified as high priority for control and eventual eradication: *Acacia angustissima*, *Aeschynomene brasiliana*, *Aeschynomene paniculata* and *Indigofera schimperi*. All are well-adapted to (various) large areas of northern Australia, prolific producers of long-lived seed and have either moderate (*A. brasiliana*) or low (other three species) palatability to livestock. Each can form dense stands, which often exclude companion plants, and are considered to have no, or very limited, production value. *Acacia angustissima* is considered a high priority weed by DNR&M in Queensland and *A. paniculata* has subsequently been nominated as a priority national 'Sleeper' weed.

Early in Phase I, each of the 100+ evaluation sites planted to one, or more, of the target plants was surveyed and the data compiled in a DPI&F database. Where present, plants were killed prior to flowering using a range of techniques and plant populations monitored over successive visits. The plants were restricted to the eradication sites and mature (seeding) plants removed from most sites. Plant populations were reduced by the end of the project, but most sites still had new plants emerging each year, many at some sites.

The proponents of Phase II, NBP.327 (2002-2005), sought to continue the plant eradication activities of Phase I, but also increase awareness of the target plants amongst stakeholders and promote best practice during pasture plant evaluation to minimise the risk of future release of undesirable plants.

Plant containment and eradication

As for Phase I, the purpose of the eradication activities was to contain the plants to current sites/properties, prevent seeding where possible and reduce plant populations. Project objectives included eradication of plants at 80% of evaluation sites, with reduced plant populations and soil-seed loads at the remainder, and the development of plans for sites where plants had not been eradicated by Project end.

There were 66 locations in Phase II, divided into 93 sites based on species present and the distribution of the species at each location. Similar methods were used to that of Phase I to

contain and reduce plant populations: timing visits to coincide with vegetative growth; killing plants with selective herbicides, manual removal, cultivation or rotational cropping and using heavy grazing, fire and tree-clearing to assist in these processes; surveying surrounding areas and monitoring plant populations. The approach was effective overall, although drought delayed activities at southern inland sites and poor access hindered treatment at a few remote sites in monsoonal areas. By June 2005 plant populations had been contained at all locations and were significantly reduced at 70% of sites. One third of locations had no plants emerge for at least two years and 86% were considered to be under absolute control (*ie* all emerging plants killed before seeding). Six locations, originally established on a large scale, contain large or mobile populations and therefore require substantial future effort.

Following internal Project review, the most appropriate and effective approach for short-term site management was considered to be extension of the eradication program, using a similar approach and effort to the previous two program phases. Additional effort and funding was required at one northern site (Batavia Downs, Weipa) to locate and control *A. paniculata*. Two funding proposals were developed by DPI&F and submitted to MLA and the Federal Government respectively.

Increased awareness amongst stakeholders

Project objectives linked to this outcome were to increase awareness of both the risk of the target plants and the eradication program amongst a broad network of land protection agencies and to develop technical information packages to assist in awareness and long term control of the target plants. A wide range of stakeholders (policy through to on-ground eradication and stakeholder industries) were exposed, and contributed, to the eradication program through: a multi-agency forum; a presentation at the 2005 Queensland Weed Symposium; and a community event. A comprehensive CD-ROM information resource was produced which includes information useful for locating, identifying and controlling the target plants.

Prevention of future release of undesirable plants

The proponents sought to document best practice for pasture plant evaluation and commercialisation, so that new beneficial plants may be developed as required by the grazing (or other primary) industries, while minimising the risk of release of undesirable plants. Within the Project, a previously developed Code of Practice was reviewed for potential effectiveness, rewritten and submitted to DPI&F, the custodian of the forage plant collection, for adoption as a working document. The use of a Code of Practice was also promoted at an international herbage seeds conference.

Benefits to the Beef Industry and other stakeholders

The benefit of the eradication program can be interpreted as the *potential cost prevented* should the target plants become widely naturalised (*ie* the cost to control them and/or losses of production). The value is difficult to estimate, but considered substantial. The benefit requires that the plants are restricted in distribution, now and in the future. This project has contributed to this end through containment and continued reduction of the target plants at all known sites. Increased involvement of agencies outside the immediate project team, as promoted during the Project, will also likely contribute to long-term control.

A secondary long-term benefit of the Project is, through the adoption of best practice protocols, the future capacity to develop new pasture plants held within the tropical forages collection, with the confidence that there is a low risk of releasing undesirable plants.

9.4 Executive summary of the third phase of the eradication program (Cox, 2010b).

Executive summary

Project B.NBP.0356 is the third phase of a twelve-year plant eradication program begun during 1999. The eradication program was instigated following concerns by government researchers and grazing industry representatives that some of the legumes evaluated in Beef Industry and state and federal plant evaluation programs may become significant weeds of north Australian grasslands.

This project concerns four perennial legumes: *Acacia angustissima* syn. *Acaciella angustissima, Aeschynomene brasiliana, Aeschynomene paniculata* and *Indigofera schimperi*. All are well-adapted to (various) large areas of northern Australia, prolific producers of long-lived seed and have either moderate (*A. brasiliana*) or low (other three species) palatability to livestock. Each can form dense stands, which often exclude companion plants, and are considered to have no, or very limited, production value. *Acacia angustissima* is currently a 'Class 1 Declared Weed' in Queensland (along with other exotic *Acacia*) and *A. paniculata* has since been recognised as a national 'Sleeper Weed' ie. a plant with the potential to have a significant impact on the economy should it become widely naturalised (Cunningham *et al.*, 2003). The potential cost, in terms of lost beef production and costs of plant eradication of *A. paniculata*, alone, was estimated at over $350 M (Brinkley and Bomford, 2002). The other two legumes were rejected prior to release because of concerns of becoming non-productive contaminants of grazing lands.

Previous plant evaluation and eradication
The plant evaluation projects, undertaken between 1986 and 1998, were of a broad scale, covering a wide range of species (over 2000 ecotypes) and land classes in Queensland. Most of the plants trialled were introduced to Australia. The projects were successful overall: characterisation of the tropical forages collection enabled researchers to identify useful species and ecotypes, some being later commercially released, while identification of species or ecotypes with little potential future value enabled informed rationalisation of the tropical forages collection. However, the projects involved the establishment, effectively biological release, of new plants at sites across Queensland on a variety of scales (small plots to 40 ha grazing trials). In keeping with responsible practice, the proponents of the evaluation programs sought to undertake actions to prevent any undesirable plants becoming widely naturalised.

During Phase I of the eradication program, NAP3.225 (1999-2002), each of the 100+ evaluation sites planted to one or more of the target plants was surveyed and the data compiled in a database (Bishop, 2003). When present, plants were killed prior to flowering using a range of techniques and plant populations monitored over successive visits. The overarching method was to: time visits to coincide with vegetative growth; kill plants with selective herbicides, manual removal, cultivation or rotational cropping and use heavy grazing, fire and tree-clearing to assist in these processes; survey surrounding areas and monitor plant populations. The plants were restricted to the eradication sites and mature (seeding) plants were removed from most sites. Plant populations were reduced by the end of the project.

The proponents of Phase II, NBP.327 (2002-2005), sought to continue the plant eradication activities of Phase I, but also increase awareness of the target plants amongst stakeholders and promote best practice during pasture plant evaluation to minimise the risk of future release of undesirable plants (Cox, 2006). There were 66 locations in Phase II, divided into 93 sites based on species present and the distribution of the species at each location. Most contained small (<50 plants) and restricted plant populations (<5 ha). Similar methods were used to those employed in Phase I to contain and further reduce plant populations. By June 2005 plant populations were believed to be contained at all locations and were significantly

reduced at 70% of sites. Overall, 86% were considered to be under absolute control (ie. all emerging plants killed before seeding). However, six locations, originally established on a large scale, contained large or mobile populations and it was impossible to kill all emerging plants and completely prevent seeding.

There was an increased emphasis on improving awareness of the target plants and the control program during Phase II. A CD-ROM information resource was produced which included information useful for locating, identifying and controlling the target plants. Awareness was improved through a multi-agency forum of government, CRC and industry stakeholders and conference publication. The proponents also refined and promoted the use of a Code of Ethics for Pasture Plant Evaluation to promote future best practice.

Project B.NBP.0356 (2005-2010)
Emphasis of the current phase of the project was on the containment of plants and reduction of plant populations and soil seed banks at all of the sites treated previously. Plant detection and treatment activities were completed as previous. Although not strictly part of the Project, complementary activities were also undertaken to assist long-term management planning for the target plants. These included the preparation of Queensland Government weed risk assessment documents, experimentation to better understand seed longevity and transfer and presentation at four weed conferences.

Two separately-funded surveying and treatment projects were also completed including all *A. angustissima* and *A. paniculata* sites included in B.NBP.0356 plus those where plants had established but were considered to have died out prior to 1999. Under these projects GPS-based surveying was conducted over a wider area than previous, plants treated and digital maps produced for each site. Four new sites were identified through improved surveying including new populations of *A angustissima* (Townsville, Charters Towers), *A. paniculata* (Mareeba) and *A. brasiliana* (Ayr). Over 8000 ha was surveyed at 'Batavia Downs' (Weipa), which contains the largest population of *A. paniculata* in Australia, and patches of plants were mapped over a total area of ~3500 ha.

Plant populations continued to decline at sites containing small populations (most sites). By the end of the project 86% of locations had 100 or fewer plants emerging annually and were considered under strict control. No plants were detected in the final two years in one third of sites. Sites with low populations included most of the *A. angustissima* and *I. schimperi* sites and over 80% of the sites containing *Aeschynomene* spp. The target plants were contained at these sites and seeding was prevented over the six years of the project at most. Eradication can be considered a realistic mid-term objective at these sites.

Large populations of *Aeschynomene* spp. at some sites in north Queensland were more difficult to treat. Control areas of *A. paniculata* near Weipa (3500 ha) and Mackay (50 ha) were expanded following detailed surveying. *Aeschynomene brasiliana* sites near Mt Garnet (600 and 70 ha) and Ayr (30 ha), previously used for evaluation on grazing, full-paddock scale, also had larger control areas by the end of 2010. Seeding was reduced at these sites, but not prevented. Accordingly, containment, rather than eradication, is a more realistic mid-term goal at these sites.

The availability of human resources became problematic in the second half of the project as new sites were identified and control areas expanded at some sites while staff numbers declined. The infestation at Weipa ('Batavia Downs') used a large proportion of project resources. Although a program was successfully implemented in the final year of B.NBP.0356, whereby plants were treated by local indigenous staff, the effort required to treat *A. paniculata* at 'Batavia Downs' reduced the capacity to treat other sites. The capacity for government staff to complete future control of the target plants needs careful consideration.

Benefits to the Beef Industry and other stakeholders

The benefit of the eradication program can be interpreted as the potential cost prevented should the target plants become widely naturalised (ie. the cost to control them and/or losses of production). The value is difficult to estimate, but considered substantial. To date, these plants are considered to have had a negligible impact on beef production because they have been restricted in distribution and therefore not affected beef pastures.

Our experience suggests *A. paniculata* has the greatest potential of the four legumes to decrease the productivity of grazing lands. This is because it has readily colonised grasslands and formed dense and persistent stands while being unpalatable to cattle and wildlife. *Aeschynomene brasiliana* is also mobile, but is more palatable and therefore arguably of less economic impact. By comparison, *A. angustissima* and *I. schimperi* are relatively immobile, forming dense stands and not readily colonising surrounding areas.

Recommendations

The following are recommended for future control of the four target legumes:

- Control of the target plants should be continued with the aim of reducing target plant populations and reducing the levels of viable seed in soil. Priority of the use of resources between species should be based on Queensland Government weed risk assessments and the predicted impact on the grazing industry of Queensland.
- Measurement and reporting of plant populations and distribution should be a key component of future control efforts. The capacity to detect escapees off-property should be improved through interaction with relevant land protection agencies.
- Landholder control of the target plants should be encouraged, improving detection of outliers/escapees and more regular control of the target plants. Control by landholders should be supported and monitored by staff familiar with the target plants and control sites.

Where possible, information developed during the eradication program should be used to assist in the development of long-term control strategies for the target weeds and other plants with weed potential in north Australian *eg.* develop guiding principles for the pre-emptive control of potential weeds in extensive grasslands.

9.5 Recommendations from the first phase of the eradication program (Bishop, 2003).

1. Management of old plant evaluation sites (monitoring, containment and eradication activities) needs to continue for another 3 to 4 years, to build on the progress made during this initial three year project. A draft new project proposal is presented in appendix 10.7.

2. Strong links need to be made with the Department of Natural Resources and Mine's (NR&M) Strategic Weed Eradication and Education Program (SWEEP) team in any ongoing project, plus continuing links with the other participating inter-agency groups.

3. Develop under graduate and post graduate research projects with Universities and Colleges to study specific environmental weed issues, as in ecological and life cycle studies and control methods.

4. Future forage plant evaluation and cultivar development programs need to follow the new NAPPEC code of practice as outlined in appendix 10.8 of this report. Short term funding for short-term evaluation projects, which specify the number of cultivars to be released, increases the risk of premature release prior to appropriate assessment of palatability and weed potential.

5. Up-to-date information packages on the role, production and sustainable grazing management benefits provided by currently available pasture cultivars, need to be develop. The current emphasis on potential environmental weeds should not be allowed to threaten or lessen the very positive benefits that introduced sown forage plant cultivars provide to grazing industries and to the environment in northern Australia.

6. Positive case studies on the economic and environmental benefits from integrating sown pastures into whole enterprise grazing/cropping production systems, need to be prepared by land holders, land managers and DPI and published in all media forms and at forum events.

9.6 Recommendations from the second phase of the eradication program (Cox, 2006).

1. The eradication program be continued for another 5 years for all species at all sites, using a similar level of effort to present, but with additional surveying of areas surrounding current eradication zones. Similar proponents, staff and resources should be used to those of the current project.
2. Additional surveying, quarantine and eradication activities be undertaken at Batavia Downs to restrict and control *Aeschynomene paniculata*. Funding in addition to that for 1. should be sought from external sources.
3. Where possible, effort should be undertaken to increase awareness of the target plants. In particular, the extension resource should be demonstrated to appropriate land protection agencies, particularly shire councils.
4. Where possible, information developed during the eradication program should be used to assist in the development of long-term control strategies for the target weeds and other plants with weed potential in north Australian eg. develop guiding principles for the pre-emptive control of potential weeds in extensive grasslands.

9.7 Recommendations from the third phase of the eradication program (Cox, 2010b).

1. Control of the target plants should be continued with the aim of reducing target plant populations and reducing the levels of viable seed in soil. Priority of the use of resources between species should be based on Queensland Government weed risk assessments and the predicted impact on the grazing industry of Queensland.
2. There should be a strong emphasis on the measurement and reporting of target plant populations and distribution to measure the effectiveness of controls. The capacity to detect escapees off-property should be improved through interaction with relevant land protection agencies.
3. Landholder control of the target plants should be encouraged, better enabling detection of outliers/escapees and more regular control of the target plants. Control by landholders should be supported and monitored, at least in the short term, by staff familiar with the target plants and control sites.
4. Where possible, information developed during the eradication program should be used to assist in the development of long-term control strategies for the target weeds and other plants with weed potential in north Australian *eg*. develop guiding principles for the pre-emptive control of potential weeds in extensive grasslands

9.8 Timing of visits and duration during B.NBP.0356.

Location	Visit dates						Control methods[1]	Typical duration of visits (days)
	2005 (July+)	2006	2007	2008	2009	2010		
Acaciella angustissima								
Brian Pastures RS		Jan.	May	Jul.	Mar., Sep.	Jul., Aug., Nov.	H, C, G	1 day, 1 officer
Campus Creek	Frequent local	Frequent local, Jun.	Frequent local	Jul.	Frequent local	Frequent local	H, M	0.5 day, 1 officer
Charleville Laboratory	Frequent local	Frequent local	Frequent local	Frequent local, Aug.	Frequent local	May	M, H	0.5 day, 1 officer
Helen's Hill	Council	Council, Jun.	Council	Apr., Jun.	Jan., Mar.	Apr.(2)	H	0.5 day, 1 officer
Hillgrove[2]				May	May	Apr.	H	0.5 day, 1 officer
Lansdown RS (1)	Frequent local	Jun.		May	Jul.	Jun.	H	1 day, 2 officers
Lansdown RS (2)[2]				May	May	Jul. Council	H, Bulldozer	1 day, 2 officers
Lyndon Caves	Nov.		Feb.	May	Feb.	Mar.		0.5 day, 1 officer
Parkhurst	Nov.	Jan., Apr.	Feb., Jul.	Jun.	Jul.	May	H, M	0.5 day, 1-2 officers
Raglan		Apr.	Feb.	Jun.		May, Aug.	H, M	0.5 day, 1 officer
Rockhampton (Etna Ck)	Nov.	Jan., Apr.	Feb.	Jun.	Jul.	May	H, M	0.5 day, 1 officer
Rosebank	Frequent local	Frequent local	Frequent local	Frequent local	Aug.	Jul.	H, M	0.5 day, 1 officer
Southedge RS[2]				Feb., May	Frequent local	May	H, mowing	1 day, 2 officers
Toorak RS	Frequent local	Frequent local	Frequent local	Frequent local	Frequent local, Dec.	Frequent local	M	0.5 day, 1 officer
Walkamin RS		Feb., Mar., Apr., May., Jun., Dec.	Jan., May	Feb.	Frequent local	Feb.(2), May	H, C	0.5 day, 1-2 officers
Warrill View			Drought	Drought	Mar., aug.	Apr.	H	0.5 day, 1-2 officers
Aeschynomene brasilana								
Batavia Downs RS	July, Oct., Dec.	Jun (2), Aug, Sep., Nov.,	Apr., May(2), Jun., Dec	Apr., May(2), Jun., Dec, Mar., Apr.(2)	Apr., May, Jun., Jul.	Apr., May, Jun.(2)	H, F, M	6-10 days, 2-3 officers
Birralee		May	May	Mar.	Mar.	May	H	0.5 day, 1 officer
Braceborough	Dec.	Mar.					H	1 day, 1 officer
Brian Pastures RS		Jan.	May	Jul.	Mar., Sep.	Jul., Aug., Nov.	H, C, G	1 day, 1 officer
Burlington		Feb., Mar.(2), May, Jul.	Mar.(2)	Mar.	Sep., Oct.	Jul.	H, G	2-4 days, 2-3 officers
Carmilla Glen		Jan., Feb.	Feb.	Mar.	Mar.	May	H	1 day, 1 officer
Crediton, Markey		Jan.				Aug.		0.5 day, 1 officer
Eungy		Jan.		Mar.		May, Aug.	C, H	0.5 day, 1 officer
Galloway Plains		Jan.	Feb.	Jun.		May	H, M	0.5 day, 1 officer
Glensfield	Dec.	Jan., Feb., Mar.	Jan., Jul.	Jul.	Mar.	Mar.	H	1 day, 1 officer

Location	Visit dates						Control methods[1]	Typical duration of visits (days)
	2005 (July+)	2006	2007	2008	2009	2010		
Goorganga	Dec.	May, Jul.	Jan., Mar., Dec.	Mar.	Mar.	Mar.	H	0.5 day, 1 officer
Granite Vale		Jan., Feb.	Feb., Dec.	Mar.	Mar.	May	H	0.5 day, 1 officer
Lamonds Lagoon		Feb., May	Apr.		Aug.		H	1 days, 2-3 officers
Lynford		Jan. Mar.	Feb., Jul.	Mar.	Mar.	Mar.	H, G	1 day, 1 officer
Mt Dangar	Dec.	May	May, Dec.			Aug.	H, M	0.5 day, 1 officer
Narayen RS	Dec.	May	Frequent local, Nov.	May, Dec.	Jul.	Jan., Apr.	H, C, G	1 day, 1-2 officers
Sorrell Hills		Jan., Apr. May	May	Sep.		Jul., Aug.	H	0.5 day, 1 officer
Springmount 1a	Sep.(2), Oct.	Mar.	Feb., Jul.	May.	Mar.		H	1 day, 2 officers
Strathdale (Blue Mt)		Feb., Mar., May, Jun., Aug.	Mar., Jul.	Mar., Aug.	Jul.	Mar., Aug.	H	1 day, 2-3 officers
Sugar bag		Apr.(2), May	Apr., Aug.	May	Oct.	Jul.	H, G	2-3 days, 2-4 officers
Swans dalrymple dogleg2			Aug.	Sep.	Aug.	Apr.	H	1-2 days, 2 officers
Swans Lagoon	Dec.	May	Mar., Aug.			Apr.	H, M	-2 days, 2 officers
Tedlands	Jul., Dec.	Jan., Feb.(2), Apr., May, Jun, Jul., Aug.	Mar., Jul.	Jul., Aug.	Jun.	Mar., Aug.	H, M	1-2 days one officer or 1 day two officers
Wadeleigh		Jan., Apr.	Feb.	Jun.	Sep.	May	H	0.5 day, 1 officer
Walkamin RS		Feb., Mar., Apr., May., Jun., Dec.	Jan., May	Feb.	Frequent local	Feb.(2), May	H, C	0.5 day, 1-2 officers
Yallatup		May				Mar.	C, H	0.5 day, 1 officer
Aeschynomene paniculata								
Batavia Downs RS	July, Oct., Dec.	Jun (2), Aug, Sep., Nov.,	Apr., May(2), Jun., Dec	Apr., May(2), Jun., Dec, Mar., Apr.(2)	Apr., May, Jun., Jul.	Apr., May, Jun.(2)	H, F, M	6-10 days, 2-3 officers
Eungy		Jan.		Mar.		May, Aug.	C, H	0.5 day, 1 officer
Glensfield	Dec.	Jan., Feb., Mar.	Jan., Jul.	Jul.	Mar.	Mar.	H	1 day, 1 officer
Goorganga	Dec.	May, Jul.	Jan., Mar., Dec.	Mar.	Mar.	Mar.	H	0.5 day, 1 officer
Granite Vale		Jan., Feb.	Feb., Dec.	Mar.	Mar.	May	H	0.5 day, 1 officer
Lynford		Jan. Mar.	Feb., Jul.	Mar.	Mar.	Mar.	H, G	1 day, 1 officer
Mt Dangar	Dec.	May	May, Dec.			Aug.	H, M	0.5 day, 1 officer
Southedge RS[2]				Feb., May	Frequent local	May	H, mowing	1 day, 2 officers
Strathdale (Blue Mt)		Feb., Mar., May, Jun., Aug.	Mar., Jul.	Mar., Aug.	Jul.	Mar., Aug.	H	1 day, 2-3 officers
Swans Lagoon	Dec.	May	Mar., Aug.			Apr.	H, M	-2 days, 2 officers
Tedlands	Jul., Dec.	Jan., Feb.(2),	Mar., Jul.	Jul., Aug.	Jun.	Mar., Aug.	H, M	1-2 days one officer

Location	Visit dates						Control methods[1]	Typical duration of visits (days)
	2005 (July+)	2006	2007	2008	2009	2010		
		Apr., May, Jun, Jul., Aug.						or 1 day two officers
Walkamin RS		Feb., Mar., Apr., May., Jun., Dec.	Jan., May	Feb.	Frequent local	Feb.(2), May	H, C	0.5 day, 1-2 officers
Indigofera schimperi								
Belcrest	Dec.	May	Drought, Nov.	May, Dec.	Jul.	Jan., Apr.	H, E	0.5 day, 1 officer
Bindaroo	Aug., Nov.	Frequent local	Frequent local	Jan.	Frequent local	Frequent local	M, C, E	0.5 day, 1 officer
Birrong		Feb.	Drought			Aug.	H	0.5 day, 1 officer
Bluff Downs			Drought	May			H, M	1 day, 1 officer
Boongargil	Dec.	May	Drought, Nov.	May, Nov.	Jul.	Jan., Apr.	C, H	0.5 day, 1 officer
Brian Pastures RS		Jan.	May	Jul.	Mar., Sep.	Jul., Aug., Nov.	H, C, G	1 day, 1 officer
Brigalow RS	Frequent local	Frequent local	Frequent local	Frequent local	Mar.	Jul., Aug.	H, C	1 day, 1 officer
Bringalily	Nov.		Drought			Feb.	C	1 day, 1 officer
Brumich			Drought	Aug.			H, M	0.5 day, 1 officer
Carramah		Mar.	Jan.				C	0.5 day, 1 officer
Ellenvale	Nov.		May, Dec.	Feb., Oct.		Aug.	C, H	0.5 day, 1 officer
Emerald RS	Dec.	Mar.	Jan., Feb.	Feb.		May, Jul., Aug., Nov.	H, M	0.5 day, 1 officer
Galloway Plains		Jan.	Feb.	Jun.		May	H, M	0.5 day, 1 officer
Glen Eden			Drought, Nov.	May, Aug.			H, M	0.5 day, 1 officer
Glenbower	Dec.	May	Drought, Nov.	May, Aug.	Jul.	Jan., Apr.	H	0.5 day, 1 officer
Goondooroo		Feb.	Drought			Aug.	H	0.5 day, 1 officer
Havilah			Drought			May	H, M	1 day, 1 officer
Holyrood	Nov.	Jul.	Feb., Apr., Oct.	Jan., Mar., Jun., Dec.	Jan.	Mar., (Feb., 2011)	H, M, E	0.5 day, 1 officer
Kapalee	Sep.	Jan.	May	Jan., Sep.	Aug.	Jul., Aug., Nov.	H	0.5 day, 1 officer
Kiamanna	Nov.		Drought			Aug., Nov. (Fe., 2011)	H	0.5 day, 1 officer
Kindon	Dec.	May	Drought, Nov.	May, Nov.	Jul.	Jan., Ar.	C, H	0.5 day, 1 officer
Kookaburra	Nov.	Feb.	May, Dec.	Jan., Oct.		Aug., Nov.	H	0.5 day, 1 officer
Mutation	Dec.	Mar.	Jan.		Mar.	Aug.	H	0.5 day, 1 officer
Myuna		May	May		Mar.	May	H	0.5 day, 1 officer
Narayen RS	Dec.	May	Frequent local, Nov.	May, Dec.	Jul.	Jan., Apr.	H, C, G	1 day, 1-2 officers
Norton	Nov.		Feb.	May			C, M	0.5 day, 1 officer
Oxford Downs	Dec.	Mar.	Jan.	Mar., Aug., Sep.	Mar.	May	H	0.5 day, 1 officer

Location	Visit dates						Control methods[1]	Typical duration of visits (days)
	2005 (July+)	2006	2007	2008	2009	2010		
Rangeview	Sep.	Feb.	May	Feb., Oct.	Aug.	Nov.	H	0.5 day, 1 officer
Rolfe Park	Dec.	Mar.	Jan.	Sep.	Mar.	Jul.	H	0.5 day, 1 officer
Sunset Downs	Dec.	May.	Drought, Nov.	May, Dec.	Jul.	Jan., Apr.	C, H	0.5 day, 1 officer
Toorak RS	Frequent local	Frequent local	Frequent local	Frequent local	Frequent local, Dec.	Frequent local	M	0.5 day, 1 officer
Ula ula	Nov.		May	May, Jul.	Mar.		M	0.5 day, 1 officer
Valencia								0.5 day, 1 officer
Valera Vale			Drought	Aug.			H, M	0.5 day, 1 officer
Willunga		Jan.	Jan.	Sep.	Mar.	May	C, H	0.5 day, 1 officer
Wrotham Park		Jan., Apr., May	Jan., Aug.	Feb.	Apr.	Jul.	H, M	1 day, 1-2 officers

[1] H = selective herbicide, C = cultivation and control by selective herbicides, M = manual removal (grubbing), G = heavy grazing pressure, E = sown exotic grasses to compete with target plants

[2] New sites added to the project following surveys in the companion projects.

9.9 Plant population status at the end of B.NBP.0356 (December 2010).

Site	Woody vegetation	Total site area (ha)	Key treated area (ha)	Population type at end of NBP.356[1]	Plant population at end of NBP.356[2]
Acacia angustissima					
Birralee 1	cleared woodland	0.1	0.1	O	0
Brian Pastures RS	cleared eucalypt woodland	1.0	0.01	O	0
Campus Creek	dense woodland	2.0	0.07	O	0
Charleville Laboratory	cleared woodland	1.0	0.025	Clean	0
Helen's Hill	disturbed exotic	0.5	1.25	O	1 (1 plant)
Hillgrove	open grassland	1.0	0.05	O	1 (1 plant)
Lansdown (CSIRO)	cleared woodland	2.0	0.07	S	2
Lansdown (Wellards)	dense woodland	10	0.5	C1	2
Lyndon Caves	cleared eucalypt	0.1	0.01	O	0
Parkhurst	cleared	0.5	Small plots	S	2
Raglan	cleared woodland	2.0	2.0	Clean	0
Etna Ck	cleared woodland	1.0	0.06	O	1
Rosebank	Mitchell grass downs	2.0	0.07	Clean	0
Southedge RS	cleared, cultivated	2.0	0.5	C1	0
Toorak RS	natural open	1.0	0.5	Clean	0
Walkamin RS	cleared woodland	5.0	1	S	1
Warrill View	forestry plantation	0.5	small plots	C2	2
Aeschynomene brasiliana					
Batavia Downs (Core area)	dense woodland	20	5	C2	3
Batavia Downs (Lydia 1)	dense woodland	40	10	S	2
Birralee 2	cleared woodland	0.01	0.01	Clean	0
Braceborough	dense woodland	0.25	0.01	No recent	
Brian Pastures	cleared eucalypt	0.5	0.2	O	0
Burlington (plant area)	cleared woodland	1.0	1.0	S	2
Burlington (near plant area)	dense woodland	20	4.0	S	4
Burlington (creek)	cense woodland	80	5.0	C2	3
Burlington (Windmill)	woodland	500	cattle area	0	2
Carmilla Glen	cleared woodland	5.0	1.0	O	0
Crediton, Markey	cleared woodland	small plots	small plots	Clean	0
Eungy 1	cleared woodland	small plots	small plots	Clean	0
Galloway Plains	cleared woodland	1.0	small plots	Clean	0
Glensfield	cleared woodland	0.4	0.4	S	3
Goorganga	cleared woodland	0.25	small plots	S	2
Granite Vale	cleared woodland	1.0	0.025	S	3

Site	Woody vegetation	Total site area (ha)	Key treated area (ha)	Population type at end of NBP.356[1]	Plant population at end of NBP.356[2]
Lamonds Lagoon (plant area)	open woodland	4.0	0.5	C1	2
Lamonds Lagoon (surrounds)	open woodland	30	5.0	S	3
Lynford	cleared woodland	1.0	small plots	C2	3
Mt Dangar	cleared woodland	1.0	0.01	Clean	0
Narayen RS 1	cleared eucalypt	0.1	Small plots	S	2
Sorrell Hills	cleared woodland	4.0	0.5	S	2 to 3
Springmount (plant area)	dense woodland	5.0	1.0	S	2
Springmount (surrounds)	dense woodland	20	20	S	2
Strathdale	cleared woodland and	8.0	0.25	O	2
Sugar bag (plant area)	dense woodland	40	40	S	5
Sugar bag (surrounds)	dense woodland	30	10	S	4
Swans dalrymple dogleg	cleared woodland	10	5.0	C2	4
Swans Lagoon 1	cleared woodland	30	5.0	C2	4
Tedlands 1	open woodland	40	2.0	S	4
Wadeleigh	cleared woodland	1.0	0.4	O	2
Walkamin RS 2	cleared woodland	5.0	0.3	S	2
Yallatup	sugar cane	1.0	small plots	Clean	0
Aeschynomene paniculata					
Batavia Downs RS (plant area)	cleared woodland	2.0	2.0	S	3
Batavia Downs RS (surrounds), (Schilling, Horse, Rectangle, Ridges, Lydia 1)	dense woodland	700	400	C1	5
Batavia Downs RS Airstrip, Pound, Lydia 2.	dense woodland	1000	1000	S	4
Batavia Downs RS Lagoon paddock	open woodland	1300	50	C1	4
Batavia Downs RS Wenlock, Spring paddock	open woodland	500+	5.0	O	1
Eungy	cleared woodland	Small plots	small plots	Clean	0
Glensfield	cleared woodland	0.4	0.4	Clean	0
Goorganga	cleared woodland	0.25	small plots	Clean	0
Granite Vale	cleared woodland	1.0	1.0	O	1
Lynford	cleared woodland	1.0	small plots	Clean	0
Mt Dangar	cleared woodland	1.0	0.01	Clean	0
Southedge RS	open woodland	20	10	S	3
Strathdale	cleared woodland and	8.0	0.25	S	2
Swans Lagoon	cleared woodland	5.0	small plots	C1	2 (from 1
Tedlands	open woodland	50	5.0	S	3

Walkamin RS	dense woodland	10	2.0	S	2
Site	**Woody vegetation**	**Total site area (ha)**	**Key treated area (ha)**	**Population type at end of NBP.356[1]**	**Plant population at end of NBP.356[2]**
Indigofera schimperi					
Belcrest	cleared brigalow belah	1.0	small plots	O	2
Bindaroo	cleared woodland	4.0	small plot	O	0
Birrong	cleared woodland	1.0	small plots	S	2
Bluff Downs	open grassland	0.5	0.5	O	1
Boongargil	cleared brigalow belah	0.5	0.5	O	1
Brian Pastures RS	cleared eucalypt woodland	7.0	7	S	2
Brigalow RS	cleared brigalow	2.0	2	S	1
Bringalily	cleared brigalow	3.0	0.5	Clean	0
Brumich (Mitchell plain)	natural open grassland	1.5	1.5	Clean	0
Brumich (Homestead pdk)	natural open grassland	0.025	0.025	Clean	0
Carramah	open	2.0	small plots	S	2
Ellenvale	cleared brigalow	2.0	small plots	Clean	0
Emerald RS	cleared woodland	1.0	0.1	S	2
Galloway Plains	cleared woodland	1.0	small plots	O	1
Glen Eden	cleared gidgee	1.5	1.5	Clean	0
Glenbower (dam)	cleared eucalypt	1.0	1.0	O	2
Glenbower (house)	cleared eucalypt woodland	1.0	1.0	O	2
Goondooroo	natural open	1.0	small plots	S	2
Havilah	cleared woodland	1.0	small plots	Clean	0
Holyrood	cleared woodland	10	1	O	1 to 2
Kapalee	cleared brigalow	0.5	0.02	S	2
Kiamanna	cleared	1.0	small plots	S	1 to 2
Kindon	cleared brigalow belah	0.5	0.5	O	1
Kookaburra	cleared brigalow	1.0	small plots	C2	2
Mutation	cleared woodland	0.5	small plots	S	2
Myuna	natural grassland	1.0	25m x 25m	O	1 (1 plant)
Narayen RS	cleared brigalow	0.25	Small plots	S	1
Narayen RS (grazing trial)	cleared brigalow	25	8.0	O	1
Norton (2008)	cleared eucalypt	0.02	Small plots	O	0
Oxford Downs	natural grassland	0.1	0.03	S	2
Rangeview	natural open	1.0	small plots	S	3
Rolfe Park	cleared woodland	0.03	0.01	S	2
Sunset Downs	cleared brigalow belah	0.5	small plots	O	1
Toorak RS	natural open	3.0	1.0	Clean	0
Ula ula	cleared eucalypt	1.0	0.025	Clean	0
Valera Vale 1	cleared and open	6.0	6.0	Clean	0
Valera Vale 2	open woodland	1.0	1.0	Clean	0
Willunga	cleared woodland	small plots	small plots	Clean	0
Wrotham Park	cleared woodland	10	1.0	O	0

[1] population types: clean = no plants recent years; o = occasional plants only; s = scattered plants; C1 = clumps of plants 1-3 m across; C2 = clumps of plants 3-10 m across; C3 = clumps > 10 m across

[2] plant population: 0 = none; 1 = 1-10 plants; 2 = 10-100; 3 = 100-1 000; 4 = 1 000-10 000; 5 = >10 000.

9.10 Visit dates, population status and control activities conducted during B.NBP.0706.

***Acacia angustissima* (syn. *Acaciella angustissima*)**

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Birralee 1	0	Aug-13 Jun-14	I I,D	0.1	0 0	NA NA		2 2	- -
Brian Pastures RS	0	Jul-12 (email) Local control, Jul-13	T,D (local)	0.01	2 Not detailed	0 0	H H	0 0	M,T M,S
Campus Creek [project officer site]	0	Jul-11 Aug-12 Mar-13 May-14	I I,T I,T I	0.07	0 1 (6 plants) 1 (2 plants) 0	NA 100R 0 NA	NA H H	1 2 2 1	- - - -
Charleville Laboratory	0	No visit		0.025					
Helen's Hill	1 (1 plant)	Aug-11 Local control Aug-12 Local control Mar-13 Local control Aug-13 Local control Oct-14 Local control	I I,T I I I	1.25	0 1 (6 plants) 0 0 0	NA 0 NA NA NA	H H H H H	1 1 0.5 0.5 0.5	M,T M,S M,S M,S M,S
Hillgrove	1 (1 plant)	Sep-11 Oct-13 Aug-14	I,T I I	0.05	2 (12 plants) 0 0	0 NA NA	H	1 1 1	- - -
Lansdown (CSIRO)	2	Regular Aug-12 Sep-12 Mar-13 Nov-13 May-14	- I,T I,T,D,P I I,T,D I,D	0.07	2 3 (300) 3 (300) 1 (1) 1 0	? 5 5 0 0 0	? H H H H H	0 3 3 1 1 1	S - - S S S
Lansdown (Wellards)**	2	Apr-12 Aug-12 Mar-May-13 (3) Jul-13 Nov-13 May-14 Sep-14	I I,T,D,P I,T,D I,T (email) I,D I,T I,T	0.5 3 3+2 5 5 5 5	3 3-4 (mature) 4 (seedlngs) 3 (seedlngs) 3 (seedlngs) 4 (seedlngs) 4	100 10 0 0 0 5 0	- F,M(R) H H - H H	1 5 10 8 1 12 10	- F,R S - Grazing - -

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Lyndon Caves	0	Mar-14	I	0.01	0	NA		1	-
Parkhurst	2	Dec-11 Jan-13 Jan-14	I,T,D,P I,T,D,P I,T,D	0.5	2 2 (40 plants) 3 (seedlngs)	50R 20R 1R	H M,H H	5 5 3	Planned M - M,H (planned)
Raglan	0	Jan-13 Jan-14	I,D I,D	2.0	0	NA		1 1	- -
Rockhampton (Etna Ck)	1	Dec-11 Jan-13 Jan-14 Oct-14	I,T I I,T D (LPO)	0.01	1 (1 plant) 0 1 (2 plants) NA	0 NA 0 NA	H H 	1 1 1 0.5	- - - LPO control
Rosebank	0	Jul-12 Mar-13 Aug-13	I,D I,D I,D	0.07	0 0 0	NA NA NA		1 1 1	- - -
Southedge RS [project officer site]	0	May-12 Jul-13 Sep-14	I,T,D,P I I	0.5	1 (3 plants) 0 0	0 NA NA	M 	2 1 1	M - -
Toorak RS	0	Jul-12 Mar-13	I,D I,D	0.5	0)	NA NA		1 1	- -
Walkamin RS [project officer site]	1	Regular checks May-12 Regular checks Aug-13 Regular checks	I,T I,T I,T I,T I,T	0.5	1 1 1 (2 plants) 1 (5 plants) 0	20R 40R 0 20R NA	H M H H 	5 4 4 0.5 1.0	- M S S M
Warrill View	2	Jul-11 Oct-12 Jun-14	I,T I,T I,T,D	0.5	2 2 (25 plants) 2 (42 plants)	0 0 0	H H M,H	2 2 2	- - -

Aeschynomene brasiliana

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Batavia Downs (Core area)	3	No visit targeting AB	NA	5					
Batavia Downs (Lydia 1)	2	No visit targeting AB	NA	10					
Birralee	0	Aug-13	I,D	0.01	0	NA	NA	1	Grazing
Braceborough	?	Oct-14	I,D	5	4	Had seeded	-	2	Grazing (wet)
Brian Pastures RS	0	No visit targeting AB		0.2					
Burlington (plant area)**	2	Nov-12 Apr-14 Jul-14	Survey, D Survey, D Survey, D	1.0	2 2 2	0 Frequent If not grazed	Grazed Grazed Grazed	2 2 2	Grazing Grazing Grazing
Burlington (near plant area)	4	Dec-12 Apr-14 Jul-14	Survey, D Survey, D Survey-D	4.0	4 4 4	0 Frequent If not grazed	Grazed Grazed Grazed	2 2 2	Grazing Grazing Grazing
Burlington (creek)	3	Dec-12	I,D	5.0	Presume 4+	0	Grazed	1	Grazing
Burlington (Windmill)	2	No visit		Many			Grazed		Grazing
Carmilla Glen	0	Aug-13	I,D	1.0	0	NA	NA	1	Grazing
Crediton	0	No visit		0.01					
Eungy	0	Aug-13	I,D	1.0	0	NA	NA	1	Grazing
Galloway Plains	0	Nov-11 Jan-13	I I	0.01	0 0	NA NA	NA NA	1 1	Grazing Grazing
Glensfield	3	May-13	I,D	0.4	1 (1 sus.)	0	-	2	Grazing
Goorganga	2	May-14	I,D	0.01	0	0	NA	1	-
Granite Vale	3	Jun-11 Apr-12 May-13	I,T,D,P I,T,D,P I	0.3	2 2 2	80 40 20	H M	30 4 2	- - Grazing
Lamonds Lagoon (plots)**	2	Dec-12 Apr-14 Jul-14	Survey, D Survey, D Survey, D	0.5	0 (burnt) 0 0	NA NA NA	Wild fire Grazed Grazed	2 2 2	Grazing Grazing Grazing
Lamonds Lagoon (outer)**	3	Dec-12 Apr-12 May-13	I,D I,D I,D	5.0	0 (burnt) 0 0	NA	Wild fire Grazed Grazed	2 2 2	Grazing Grazing Grazing
Lynford**	3	May-13 Jun-14	I I	0.01	0 0	NA NA	NA NA	1 1	Grazing Grazing
Mt Dangar	0	No visit		0.01					

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 2011-12 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Narayen RS	2	Nov-11 Mar-12 Mar-13 Jun-13	I,D I,D I,D I,D	0.01	0 0 0 0	NA NA NA NA		1 1	Slashed Slashed Slashed Slashed
Sorrell Hills	2 to 3	Nov-11	I	0.5	0	0 (grazed)	NA	3	-
Springmount (plant area)	2	Sep-14	I,D	1.0	2	If not grazed	Grazed	1	Grazed
Springmount (surrounds)	2	Not checked		20		?	Grazed		Grazed
Strathdale	2	Aug-11 Apr-12 May-13 Jun-14	I,T I,T I,T I,T	0.25	2 2 2 2	0 0 0 0	H H H H	1 1 1 1	Grazed Grazed Grazed Grazed
Sugar bag (plant area)**	5	Dec-12 Apr-14 Jul-14	Survey, D Survey,D Survey,D	40	4-5 4-5 4-5	5 90+ 90+	Grazing Before grazing	2	Grazing Grazing Grazing
Sugar bag (surrounds)	4	Dec-12	I	10	4+	Presume so	Grazing	1	Grazing
Swans dalrymple dogleg	4	Oct-14	I,D	5.0	4+	80+	No grazing	1	-
Swans Lagoon**	4	Jun-11 Mar-13 Oct-14	I I,D I,D	5.0	4 4 4+	70 90 80	No grazing Grazing	1	- - Grazing
Tedlands	4	May-13 Jun-14	I,D I,D	2.0	4 4	60 70	Grazing Grazing	1 1	Grazing Grazing
Wadeleigh	2	Jan-13 Dec-13	Survey Survey	0.4	0 0	NA NA	Grazing Grazing	1 1	Grazing Grazing
Walkamin RS [project officer site]	2	Jan-11 Regular 2012 Sep-14	I,T I I	0.2	2 2 2	0 0 30	H Slashing Slashing	1 0.5 0.5	Slashing Slashing Slashing

Aeschynomene paniculata

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 2011-12 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Eungy	0	Aug-13	I,D	0.01	0	NA		2	-
Glensfield	0	May-13	I,D	0.4	0	NA		1	-
Goorganga	0	May-13 Jun-14	I,D I,D	0.01	0 0	NA NA		1 1	- -
Granite Vale	1	Jun-11 Apr-12 May-13 Jun-14	I,T,D,P I,T,D,P I,T,D I,T	0.25	2 (12 plants) 2 1 (1 plant) 0	100R 10R 0 NA	M M,H M	30 4 2 4	Planned M - M M
Lynford	0	May-13 Jun-14	I I	0.01	0 0	NA NA		1 1	- -
Mt Dangar	0	No visit		0.01					
Southedge RS [project officer site, transfer of ownership]	3	Jun-11 Mar-12 Apr-12 May-12 Jul-13 Aug-13 Sep-14	I,T I,T I,T I,T I,T I,T I,T	8	3 3 2 3 2 3 3	80R 0 0 80 50R 25R 50	H H H H H M,H M,H	12 8 8 8 8 12 12	S S S S - - -
Strathdale	2	Aug-11 Apr-12 May-13 Aug-13 Jun-14	I,T,D I,T,D I,T,D I,T,D I,T,D	0.25	2 3 3 (205 plts) 2 (36 plts) 3 (465 plts)	100R 5R 1R fewR 70 immature	M H H H,M H	8 8 8 2 5	- - - - -
Swans Lagoon	2	Jun-11 Mar-13 Oct-14	I,T I,D I,D	0.05	2 0 0	80R NA NA	H	8 2 2	- - -
Tedlands	3	Jun-11 Aug-11 Apr-12 May-13 Aug-13 Jun-14	I,T,D I,T,D I,T,D I,T,D I,T,D I,T,D	20	3 3 3 3 (800plnts) 3 (160 plts) 3 (400 plts)	80R 10R 20R 20R 50R 50R	M,H H H, M M,H H H	30 16 24 12 8 8	- - - - - -

Site	**Plant population at end of NBP.356** 1=1-10 2=10-100 3=100-1000 etc	**Visit dates**	**Activities completed** I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	**Key treated area (ha)**	**Plant population 2011-12** 1=1-10 2=10-100 3=100-1000 etc	**Plants with mature seed (%)** R=removed and destroyed	**Control method** H=herbicide C=cultivation M=mechanical F=fire	**Officer work time on site (hrs)**[1]	**Landholder contribution** M=monitoring S=spraying C=cultivation R=renovation F=fire
Walkamin RS [project officer site]	2	Oct-11 Dec-11 Jan-11 Jun-12 Mar-13 Jun-13 Jun-14 + regular	I,T I,T,D,P I,T I,T I,T I,T I,T	0.4	2 2 2 2 4 (1500 plts) 2 (100 plts) 3 (500 plts)	80R 0 0 0 0 100R 100R	H H,F H H,F H H H	12 12 4 2 3 4 4	S S,F S S,F S S S

Note: Havilah also checked in August 2013 and no plants were found.

Indigofera schimperi

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 2011-12 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Belcrest (Wandoan)	2	Nov-11 Mar-12 Mar-13 Jun-13 Dec-13 Apr-14	I,T I,T I,T,D I,D I,D I,D	0.01	2 (18 plants) 2 (16 plants) 1 (4 plants) 0 0 0	0 0 0 NA NA NA	H H H	3.5 3.5 2 2 2 2	- - - - - -
Bindaroo	0	No visit		0.01					
Birrong	2	May-11 Nov-11 Jan-12 Local control 2013-14 local	I,T I,T I,T,D Phone Phone	0.01	2 2 2 ? 2 (30 plants)	0 10 0 ? 0	H H H H H	2 2 3 0 0	- - C (prep) MS MS
Bluff Downs**	1	Aug-2013 – owner not supporting access		0.5	?	?			None
Boongargil (Toobeah)	1	Nov-11 Mar-12 Mar-13 Jun-13 Dec-13 Apr-14	Too wet to visit I,T,D I,D Phone I,D,P	0.5	- - 3 (686 plts) 0 ? 0	- - 0 NA ? 0	- - H C C C	- - 4 1 - 1	C C C C C C
Brian Pastures site 1	2	May-11 Oct-11 Oct-11 Jul-13, local control	I,D I,T,D T I,T,D,P	7	2 2 2 (60 plts)	80 0 0	- H,F H	1 2	M M,F,H C M,C,S
Brian Pastures site 2	2	May-11 Oct-11 Oct-11 Jul-13, local control	I,T,D I,T,D T I,T,D,P	1	2 2 - 2 (23 plts)	0 0 - 0	H H H	1 - - 3	M,S M,H C M,C,S
Brian Pastures site 3	Not specified	May-11 Oct-11 Jul-13, local control	I,T T D	1	2 1 ?	? 0 Suspect 0	H - H	1 - 0	M,S H S
Brigalow RS	1	Jan-12	T,I,D	2	2	80R	Cut,H	3	M
Bringalily	0	No visit		0.5					

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 2011-12 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Brumich (Mitchell plain)	0	No visit		1.5					
Brumich (Homestead)	0	No visit		0.025					
Carramah	2	Nov-11	I,T,D	0.01	2	0	H	3	C (2010)
		Jan-12	I,T,D		1	0	H	2	C (prep)
		Apr-12	Too wet						
		May-13	I,D		0	NA		1	C
		May-14	I,D		0	NA		1	C
Ellenvale	0	Aug-11	I	0.01	0	NA		1	-
		Nov-12	I		0	NA		1	-
		May-13	I,D		0	NA		1	-
		May-14	I		0	NA		1	-
Emerald RS	2	May-11	I	0.1	2	80	None	2	-
		Nov-11	I		2	80	None	1	-
		Apr-12	I		2	80	None	1	-
		May-13	I		Not noted	80+	None	2	-
		May-14	I,D,P		?	80+	Control plan	1	-
Galloway Plains	1	Nov-11	I	0.01	0	NA		1	-
		Jan-13	I		0	NA		1	-
		Jan-14	I,D (phone)		0	NA		1	-
Glen Eden	0	No visit		1.5					
Glenbower (dam)(Pitt.)	2	Nov-11	I	1.0	0	NA		1	-
		Mar-12	I		0	NA		1	-
		Mar-13	I,D		0	NA		1	-
		Jun-13	I,D		0	NA		1	-
		Dec-13	I,D		0	NA		1	-
		Apr-14	I,D		0	NA		1	-
Glenbower (house) (Pitt.)	2	Nov-11	I	1.0	0	NA	NA	1.5	C
		Mar-12	I,T		3 (104 plnts)	0	M (pulled)	3	C
		Mar-13	I,D		0	NA		1	-
		Jun-13	I,D		0	NA		1	-
		Dec-13	I,D		0	NA		1	C
		Apr-14	I,T,D		3 (200 plts)	0	C		C
Goondooroo	2	Nov-11	I,T	0.01	3	80	H	4	-
		2013-14 local	Phone		?	?	H	4	MS

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 2011-12 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Havilah	0	May-14	I,D	0.01	0	NA		2	-
Holyrood	1 to 2	Aug-11	I	1	0	NA	NA	2	-
		Apr-12	I,T		1 (1 plant)	0	M (dug)	2	-
		Sep-12	I,D		0	NA		2	-
		May-13	I,D		0	NA		2	-
		May-14	I		0	NA		2	-
Juanita / Fernlees	clean	May-11	I	0.01	0	NA	NA	1	-
Kapalee	2	May-11	I,T	0.02	2	50	Cut,H	2	-
		Oct-11	I,T		2	?	H	2	-
		Jul-13	I,T		2	8	H	2	-
Kiamanna	1 to 2	Aug-11	I	0.01	0	NA	NA	1	-
		Apr-12	I,T		1 (1 plant)	0	M (dug),H	2	-
		Mar-13	I,D		0	NA		1	-
		May-14	I		0	NA		2	-
Kindon	1	Nov-11	I,T	0.5	1 (1 plant)	0	H	1.5	-
		Mar-12	I,T,D		1 (2 plants)	0	H	1	R,C (planned)
		Mar-13	I,D		0	NA		1	-
		Jun-13	I,D		0	NA		1	C
		Dec-13	I,D		0	NA		1	-
		Apr-14	I,D,P		0	NA		1	-
Kookaburra	2	May-11	I	0.01	2	0	None	2	-
		Local control 2012			?	?	H	?	M,S
		Jul-14	I,D,P		1	0		2	M,S
Mutation	2	May-11	I,T	0.02	3	20	H	4	-
		Nov-11	I,T,D		3	50	H	4	M
		Jan-12	I,T		3	0	H	3	-
		May-14	I,T,D		3	0	H	3	-
Myuna	1 (1 plant)	Aug-13	I	0.05	0	NA		2	-
		May-14	I,D		0	NA		2	-

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000 etc	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 2011-12 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Narayen RS (LCS, x3)	1	Nov-11 Mar-12 Mar-13 Jun-13 Dec-13 Apr-14	I,T,D I,T,D I,T,D I,D I,D I,D,P	0.01	1 (2 plants) 1 (7 plants) 1 (3 plts) 0 0 0	0 0 0 NA NA NA	H H H	5 6 6 1 1 1	M M Grazed Grazed Grazed Grazed
Narayen RS (grazing)	1	Nov-11 Mar-12 Mar-13 Jun-13 Dec-13 Apr-14	I,D I,D I,D I,D I,D,P I,D,P (new)	8.0	2-3 2-3 2-3 2-3 2-3 2-3	0 0 0 0 0 0	Slashing Slashing Slashing Slashing Slashing Slashing	1 2 2 2 2 2	Slashed Slashed Slashed Slashed Slashing+H Slashing+H
Norton (2008)	0	Sep-11 Mar-14	I,T I,T	0.01	1 (2 plants) 0	100R NA	M	2 2	- -
Oxford Downs	2	Aug-11 Apr-12 May-13 Aug-13 Jun-14	I,T I,T,D,P I,T,D I,T,D I,T,P	1.0	2 3 3 (198 plts) 2 (13 plts) 1 (6 plts)	5 5 10R 0 0	H H H,M H H	4 4 4 1 2	- - - - -
Rangeview	3	May-11 Aug-11 Oct-11 Jan-12 Jul-13 May-14	I,T I,T,D I,T I,T,D I,T I,T,D	0.02	3 3 4 2 3 (120 plts) 1 (2 plts)	20 20 5 0 0 100R	H H H H H M	3 2 5 3 3 3	- M M R C,S C
Rolfe Park	2	Oct-11 Jan-13	I,T I	0.01	3 0	0 NA	H	4 1	- -

Site	Plant population at end of NBP.356 1=1-10 2=10-100 3=100-1000	Visit dates	Activities completed I = inspection, T = treatment, D = discussion with manager, P = practical demonstration	Key treated area (ha)	Plant population 2011-12 1=1-10 2=10-100 3=100-1000 etc	Plants with mature seed (%) R=removed and destroyed	Control method H=herbicide C=cultivation M=mechanical F=fire	Officer work time on site (hrs)[1]	Landholder contribution M=monitoring S=spraying C=cultivation R=renovation F=fire
Sorrel Hills	Not specified	Nov-11 Jan-13	I,T I	0.02	2 (54 plants) 0	0 NA	H	3 1	- -
Sunset Downs (Tara)	1	Nov-11 Mar-12 Mar-13 Jun-13 Dec-12 Apr-12	I I I,D I,D I I,D	0.01	0 0 0 0 0 0	NA NA NA NA NA NA		2 2 2 2 2 2	- - - - - -
Toorak RS	0	Mar-13	I	1.0	0	NA		1	-
Ula ula	0	No visit		0.025					
Valencia	NA	May-11 Oct-11 Apr-12 May-13 May-14	I,T I,T I,T,D,P I,D,T I,T,D,P	0.01	2 (30 plants) 0 1 (6 plants) 1 (2 plants) 1 (1 plant)	20 NA 100R 0 0	Cut, H NA M (dug),H M,H M,H	2 1 1 1 1	- - M - MS
Valera Vale 1	0	No visit		6.0					
Valera Vale 2	0	No visit		1.0					
Willunga	0	Aug-13	I,T	0.01	1 (3 sus.)	0	H	2	-
Wrotham Park	0	Jul-12 Jun-13 Jul-13 Oct-14	I I,T I,D I,D	1.0	1 1 (5 sus.) 0 0	0 0 NA NA	M H	2 2 2 2	- - - -

[1] equivalent hours of one officer completing activities on-site (not including travel)

9.11 Management plans (selected excerpts) for 'Lansdown 2' (Regional Council property leased by Wellards Pty Ltd), Biosecurity Queensland.

COMMUNITY & ENVIRONMENTAL SERVICES
INTEGRATED SUSTAINBILITY SERVICES

City of Townsville

PROPERTY PEST MANAGEMENT PLAN

Property Name: **Lansdown Station**

Property Owner: **Townsville City Council**

Property Lessee: **Wellard**

Property Address: **132 Bidwilli Road, Calcium**

Townsville City Council use only

Property number:	501444	Assessment number:	5902101

Plan assessed by:	Russell Warner
Date:	October 2009

Plan approved:	Y / N	Authorised officer:		Date:	

Approved copy returned to owner:	Y / N	Date:		Initials:	

Comments on plan:		Pests on council GIS:	Y / N

TOWNSVILLE CITY COUNCIL PO BOX 1268, TOWNSVILLE QUEENSLAND 4810 TELEPHONE >> 07 4727 9000

Property Pest Management Plan

Pests Species

These are the known declared pest species and Townsville Local Government Area Pest Management Plan high priority pest species identified on or near the property.

Pest Status	Pest Species (* Weeds of National Significance)	Known locations and impacts associated with these pests	Density & area of infestation	Risk of introduction to the property (High/Low)
Class 1	White ball acacia	Highly localised infestations - 1 at Campus Creek JCU - 1 at current CSIRO property Woodstock - 1 infestation at Lansdown Station. Was introduced by CSIRO as fodder trial - is currently under eradication campaign by Biosecurity Qld DPI&F.	2ha in southern paddock adjacent Quarry Road and Powerlink easement	
	Siam	Localised infestations have appeared in Townsville along Mt Stuart Rd, Oak Valley, Central Creek, Bohle River and Alice River. These infestations are being treated by Biosecurity Qld DPI&F. Siam can quickly invade and establish to outcompete pastures and native vegetation. Young Siam weed is toxic to stock and can cause issues for some allergy prone people.	Nil	Low - isolated infestations on adjacent properties - ensure proper weed hygiene practices
Class 2	Chinee Apple	Throughout the Townsville area. Dense infestations of Chinee Apple produce impenetrable thorny thickets that seriously hamper stock management and reduce pasture production.	Scattered densities throughout entire property	
	Parthenium weed	Isolated infestations at Stuart Creek, Alligator Creek, AMH, Roseneath, Oak Valley, Kelso, top of the Ross River Dam and at the headwaters of Majors Creek. Parthenium reduces pasture production potential. It can invade any disturbed soil and poorly managed pastures. It can cause serious hay fever and dermatitis.	Rare plants have been seen and controlled on road nearest main depot / laneway	
	Sicklepod	Isolated patches occur from Rollingstone to adjacent to the Ross River Dam. Other infestations have been recorded near Calcium and Oonoonba. Sicklepod can invade and completely dominate pastures. It usually only invades natural areas after significant disturbance.	Scattered densities throughout entire property	
	Rubber Vine	Along most coastal creeks and widespread throughout the Townsville area. Rubber vine can form dense impenetrable thickets that can reduce pasture productivity as well as smother native vegetation.	Scattered densities throughout entire property	
	Feral Pigs	Scattered populations in rural areas of Townsville. These pests can affect productivity through the destruction of crops.	Generally low numbers with small local populations	
	Wild Dogs	Scattered populations in rural areas of Townsville. These pests can affect productivity through lower calving rates and predation of stock.	Very occasional	

Property Pest Management Plan

Pest Prioritisation - Risk Assessment for Property

Feasibility	Relative Threat/Impact (*TLGAPMP 2004-2008*)		
	High (Targeted for eradication / exclusion)	**Medium** (Area Control program)	**Low**
Easy to Control - Few in numbers - Easy access - Cheap control methods	**Very High** White ball acacia Lantana Custard apple Parthenium weed Grader grass	**High** Chinee apple Rubber vine	**Medium**
Hard to Control - Heavy infestations - Poor access - Costly control methods	**High** Sicklepod	**Medium** Leucaena	**Low**

Available Resources

Current Resources		
People Land Protection staff Ronald Dixon Kendrick Cox	**Person/company** Townsville City Council Manager Lansdown DPI&F 4091 9324	**Skills** Declared pest control Declared pest control White ball acacia eradication
Operational budget	Wellard Townsville City Council: 2008/09 - $137,148 2009/10 - $75,000 2010/11 - $TBC	
Equipment	Council preferred supplier arrangement for Woody Weed Control	

Property Pest Management Goals

	Desired Goals
Vision	*"To manage pests on the property to maintain its productive capacity and to protect its land, water biodiversity and cultural heritage whilst promoting the use of best practice pest management by Townsville City Council"*
Short Term (1 Year)	- Meet Councils legal obligations under the *Land Protection (Stock Route Management) Act 2002*, and promote best practice pest management - Create a declared weed free buffer to adjacent properties - Remove all mature White ball acacia, Lantana, Chinee apple, Rubber vine and Custard apple from the property - Control all known infestations of Sicklepod and Grader grass and survey and treat new infestations - Maintain the property free of Siam weed, Parthenium weed and Mimosa bush - Investigate, trial and undertake a variety of control techniques for wild dogs and feral pigs
Medium Term (2-5 Years)	- Maintain control activities on White ball acacia, Lantana, Chinee apple, Rubber vine and Custard apple regrowth - Maintain control activities over Sicklepod and Grader grass infestations - Maintain the property free of Siam weed, Parthenium weed and Mimosa bush - Participate in coordinated Wild dog and Feral pig control operations - Maintain good weed hygiene practices
Long Term (6-10 years)	- Eradicate all declared weeds from the property - Participate in coordinated Wild dog and Feral pig control operations - Maintain good weed hygiene practices

Property Pest Management Plan

Weed Hygiene Plan - Preventing the Spread of Pests

Action	Location	Timeframe
Wash down all vehicles entering the property that may have seed present	At front of main depot	Prior to entry
Ensure all machinery/plant entering the property is accompanied by a weed hygiene declaration	At front of main depot	Prior to moving into other areas
Quarantine all new stock	Quarantine paddock	7-14 days
Ensure soil / fodder is sourced from areas without weeds present or obtain weed hygiene declaration.	At front of main depot	
Exclude stock from White ball Acacia site	2ha paddock adjacent to Manton Quarry Road and Powerlink easement	10 years after last known seeding event takes place

Past Pest Management Activities

Extensive work chemical and mechanical control of pests have occurred over the past 3 years (2007-08-09) and this work includes but not limited to:

- Mechanical removal of Leucaena along fence lines and Manton Quarry Road
- Mechanical removal of vast areas of Chinee apple, Rubber vine and Lantana
- Foliar spraying infestations of Sicklepod with Grazon
- Coordinated chemical control of wild dogs
- Trapping and shooting of feral pigs

Pest Management Plan for *Acaciella angustissima* (syn. *Acacia angustissima*) on the Townsville Regional Council property near Woodstock.

Background information

Acacia angustissima is a perennial shrub legume native to subtropical and tropical America. It was introduced for cattle forage research during the 1970s and 80s, and was deemed unsuitable for further development. This species is restricted to a few sites in Queensland, all close to experimental plots where it was first introduced. *Acacia angustissima* is a potential contaminant of grazing lands in northern Australia and is a 'Class 1 Declared Plant' in Queensland. The plant is unpalatable to livestock due to a high tannin content in leaves and produces masses of long-lived (hard-seed dormancy) seeds, similar to other weedy *Acacia* species. Field observations within Queensland suggest that *A. angustissima* can invade disturbed sites, including dry-land forests and some riparian habitats. Once established, it can thrive in a variety of climatic conditions including extended periods of drought or cold climates, enabling it to successfully colonise many climatic regions within Australia.

Figure 1: *A. angustissima* seed pods and flower

Site location:

The site is located on council owned land 45km south-west of Townsville and is adjacent to CSIRO's Lansdown research facility. The area containing *Acacia angustissima* is currently being leased to Wellards Pty. Ltd., to raise cattle prior to export.

Site description:

The *Acacia angustissima* infestation is limited to a paddock, fenced off from cattle, about 1-2 hectares in size. The infestation is dense, with trees at an average height of 2 metres, and covers an area of approximately 1 ha. There is a large amount of fallen seed following seeding events over the last few years.

Aim: To provide a pest management plan for an infestation of *Acacia angustissima* at Woodstock, QLD, with the end result being a handover of responsibility to the landowner provided ongoing management is routine.

Stakeholders involved:

Activities will involve collaboration between staff from Department of Agriculture, Forestry and Fisheries, Townsville Regional Council and Wellards. Staff from Biosecurity Queensland will also provide project support.

Work plan

Stage 1: Mechanical removal of all mature shrubs with a bulldozer fitted with an Ellrot plough (approx. 1 - 2 days duration)
Staff involved: DAFF, Townsville Regional Council, and Wellards.
Whilst all staff are not required to supervise heavy machinery, full involvement is expected from all parties in the initial stages. If fire is included as a component before or after the manual removal of the target weeds, more staff may be required as per fire management/permit guide lines.

Stage 2: Follow-up management of dense seedling regrowth (up to 2 years in duration)
Staff involved: Townsville Regional Council, DAFF and Wellards
Control seedling regrowth every 4 – 6 months (depending on growth rate and weather conditions) through foliar spraying with suitable herbicides. DAFF has quad-bikes suitable for this purpose.

HANDOVER – Landowner to take responsibility for regrowth management with occasional checks of plant population by DAFF and Biosecurity Queensland staff.

Stage 3: Management of minor seedling regrowth (approx. 2 years)
Staff involved: Townsville Regional Council, with Wellards possibly assisting.
Continual foliar spraying of seedling regrowth will every 4-6 months, until no more seedlings are found (DAFF staff may assist to ensure seedling regrowth is being maintained appropriately).

Stage 4: Monitoring
Staff involved: Townsville Regional Council, with Wellards possibly assisting.
Inspect for seedling recruitment and re-growth of treated plants every 4-6 months, particularly 1-2 months after significant rainfall, Complete foliar spraying if seedlings are found until no seedlings are found.

Time frame

Total eradication, providing follow up treatments are maintained will not occur for at least 5-10 years (according to seed longevity). However rigorous control of plants in the first two years as described above should leave the site in a state where seedlings can be easily accessed and routinely controlled, so that follow-up treatments can then be maintained by the landowner.

Milestones/objectives:

1. Manual removal of all mature trees
2. Introduction and implementation of an effective spray program which can be conducted routinely by the land-holder.

Resources required:

Ellrot Plough, spray units, herbicide and labour

Budget: TBA

Control/methods:

A combination of manual and herbicide control will be used on this site. Initially an Ellrot plough will be used to physically remove mature trees, follow-up treatments will then be conducted by foliar spraying seedlings with a suitable registered herbicide (e.g. Grazon®). If seedlings are missed or follow-ups cannot be maintained and foliar spraying is ineffective on the taller seedlings, basal barking or the cut stump method can be applied along with a suitable registered herbicide (e.g. Access® and diesel).

9.12 Images of renovating the 'Lansdown 2' site (Regional Council property leased by Wellards Pty Ltd) for control of Acacia angustissima. **(progressing as reading a page) 1. the site prior to clearing (very dense infestation); 2. outlier plants prior to clearing: 3. Ellrot plough used to uproot mature plants (after a fire); 4. cleared site shortly after ploughing; 5. site after wet season rainfall; 6. piles of sticks after Wellards staff stick-raked the site.**

9.13 Project officer perceived progress toward plant containment and control, project planning meeting August 2014.

Location	Latitude	Longitude	Species	Site visits (Y/N)			Population			Best control method	Landowner awareness			Landowner effort		Future effort?
				2011/12	2012/13	2013/14	Area (ha)	Population	Type		ID	Spread	Method	Method	% done	(U,S,I,N)
Batavia Downs RS	12.66	142.66	*A. brasiliana*	y	y	y	3	4	s	no control	y	y	n	NA	NA	NA
			A. paniculata	y	y	y	5	5	s,f	h, fire	y	y	y	h,fire	80	S
Wrotham Park	16.71	144.07	*I. schimperi*	y	y	y	2	1	o	h,g	n	y	y	n	0	S
Southedge RS	16.98	145.34	*A. paniculata*	y	y	y	3	3	s	h	n	n	n	n	0	?
			A. angustissima	y	y	y	2	0	o	h,g	n	n	n	n	0	?
Walkamin RS	17.13	145.42	*A. angustissima*	y	y	y	2	1	i	h,m	y	y	y	h,m	100	S
			A. brasiliana	y	y	y	1	1	i	h	y	y	y	h	100	S
			A. paniculata	y	y	y	3	3	s	h	y	y	y	h	100	S
Springmount	17.24	145.3	*A. brasiliana*	n	n	y	sus. 3	sus. 3	sus. F	no control	n	n	n	n	0	sus. N
Burlington	17.82	144.36	*A. brasiliana*	y	y	y	5	sus. 3,4	s	no control	n	n	n	n	0	sus. N
Sugarbag	17.94	144.99	*A. brasiliana*	y	y	y	4	4	s,f	no control	y	y	y	n	0	N
Lamonds Lagoon	18.37	145.14	*A. brasiliana*	y	y	y	3	0	n1	no control	y	y	y	NA	NA	N
Helen's Hill	18.78	146.13	*A. angustissima*	y	y	y	1	0	n5	h	y	y	y	h	100	I
Campus Creek	19.32	146.75	*A. angustissima*	y	y	y	2	1	i	h	y	y	y	h	100	I
Lansdown (CSIRO)	19.66	146.83	*A. angustissima*	y	y	y	2	1	i	h	y	y	y	h	100	I
Lansdown (Lennards)	19.65	146.81	*A. angustissima*	y	y	y	3	5	s	m,h	y	y	y	y	50	S
Bluff Downs	19.67	145.5	*I. schimperi*			no access	1	sus 1	i	h	n	n	n	n	0	U
Hillgrove	19.68	145.76	*A. angustissima*			y	1	0	n	NA	NA	NA	NA	NA	NA	NA
Swans Lagoon	20.08	147.17	*A. paniculata*	y	y	y	1	1	i	h	n	n	n	n	0	?
			A. brasiliana	y	y	y	3	4	f	no control	n	n	n	n	0	?
Mt Dangar	20.2	148.67	*A. brasiliana*		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
			A. paniculata		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
Yallatup (remove)	20.3	148.5	*A. paniculata*				sus. 1	sus. 0	sus. N5	NA	NA	NA	NA	NA	NA	suspected clean
Goorganga	20.45	148.45	*A. brasiliana*			y	1	0	n1	NA	NA	NA	NA	NA	NA	
			A. paniculata			y	1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Braceborough	20.48	145.82	*A. brasiliana*			y	?	4?	s	no control	y	y	y	n	0	S
Birralee	20.65	147.68	*A. angustissima*	y		y	1	0	n1	NA	NA	NA	NA	NA	NA	suspected clean
			A. brasiliana	y		y	1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
			A. paniculata	y		y	1	0	n5	NA	NA	NA	NA	NA		suspected clean
Myuna	20.67	147.67	*I. schimperi*	y		y	1	1	o	g,h	?	Y	T	N	0	U (leasing back)
Havilah	20.88	147.86	*I. schimperi*	y		y	1	0	n	NA	NA	NA	NA	NA	NA	NA
Toorak RS	21.03	141.78	*A. angustissima*		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
			I. schimperi		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
Crediton	21.18	148.5	*A. brasiliana*		y		2	0	n	NA	NA	NA	NA	NA	NA	NA
Tedlands	21.36	149.18	*A. brasiliana*	y	y	y	4	3	s	no control	y	y	y	n	0	sus. N or S
			A. paniculata	y	y	y	4	4	s, f		y	y	y	n	0	sus. S
Glensfield	21.47	147.97	*A. brasiliana*	y	y	y	1	0	n1	no control	NA	NA	NA	NA	NA	NA
			A. paniculata	y	y	y	1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Strathdale	21.53	149	*A. paniculata*	y	y	y	3	2	s	h	y	y	y	n	0	sus. N or S
			A. brasiliana	y	y	y	3	3	s	no control	y	y	y	n	0	sus. S
Lynford	21.75	148.67	*A. brasiliana*	y	y	y	3	1	o	h	y	y	y	n	0	sus. N
			A. paniculata	y	y	y	1	0	n5	NA	NA	NA	NA	NA	NA	NA
Oxford Downs	21.82	148.67	*I. schimperi*	y	y	y	2	2	s	h,g	y	y	y	n	0	?
Carmilla Glen	21.96	149.5	*A. brasiliana*			y	2	sus. 0		no control	?	?	?	n	0	needed?
Willunga	22.2	148.37	*I. schimperi*			y	1	1	i	h	n	n	n	n	0	?
Eungy	22.36	148.87	*A. brasiliana*		y		1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
			A. paniculata		y		1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean

Location	Latitude	Longitude	Species	Site visits (Y/N)			Population			Best control method	Landowner awareness			Landowner effort		Future effort?
				2011/12	2012/13	2013/14	Area (ha)	Population	Type		ID	Spread	Method	Method	% done	(U,S,I,N)
Carramah	22.87	147.9	*I. schimperi*	y	y	y	1	0	n	NA	NA	NA	c	NA	NA	NA
Rosebank	23.54	144.26	*A. angustissima*	y	y	y	1	0	n	NA	NA	NA	c	NA	NA	NA
Granite Vale	22.42	149.53	*A. brasiliana*	y	y	y	2	2	o	no control	y	y	y	NA	NA	NA
			A. paniculata	y	y	y	2	1	o	h	y	y	y	n	0	sus. S
Mutation	22.48	147.48	*I. schimperi*	y	y	y	2	2	s	h	worker?	?	h (crop)	h (crop)	10	U
Etna Ck	23.23	150.3	*A. angustissima*	y	y	y	1	1	i	h	n	n	n	n	0	U (prison)
Parkhurst	23.32	150.52	*A. angustissima*	y	y	y	2	2	f	h	y	y	y	30	h	s
Emerald RS	23.46	148.01	*I. schimperi*	y	y	y	2		s	h	?	?	not yet	n	0	need manager push
Sorrell Hills	23.57	149.68	*A. brasiliana*	y		owner chat	2	3	f	h	?	y	y	n	0	S
			I. schimperi	y		owner chat	2	1	o	h	?	y	y	n	0	S
Raglan	23.75	150.75	*A. angustissima*	y	y	y	2	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Goondooroo	23.82	148.12	*I. schimperi*	y		owner chat	2	3	f	h	y	y	y	n	0	S
Galloway Plains	24.1	150.57	*A. brasiliana*	y	y	y	2	0	n5	no control	NA	NA	NA	NA	NA	suspected clean
			I. schimperi	y	y	y	2	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Birrong	24.23	148.3	*I. schimperi*	y	y	owner chat	5	2	i	h	y	y	h	h	20	s
Wadeleigh	24.28	151.53	*A. brasiliana*	y	y	y	2	0	n1	no control	n	y	y	NA	NA	suspected clean
Kapalee	24.4	150.42	*I. schimperi*	y	y	y	2	2	s,i	h	y	y	h	n	0	n,s
Rangeview	24.7	150.1	*I. schimperi*	y	y	y	2	1	i	c,h	?	?	c	c	50	S
Brigalow RS	24.82	149.77	*I. schimperi*	y	y	sold	2	2	s	h	?	?	?	n	0	?
Brian Pastures RS	25.4	151.4	*A. angustissima*	y	y	local	2	1	i	h	y	y	y	h	50	S
			A. brasiliana	?	?	?	to check			no control	sus. N	sus. N	sus. N	NA	NA	sus. s
			I. schimperi	y	y	local	3	3	s	c,h	y	y	c,h	c,h	80	S
Kiamanna	25.42	148.85	*I. schimperi*	y	y	y	1	1	n1	h	?	y	y	n	0	S
Brumich	25.68	146.2	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Narayen RS	25.68	150.88	*A. brasiliana*	y	y	y	2	0	n1	no control	n	n	n	NA	NA	suspected clean
			I. schimperi	y	y	y	3	4	s	h	y	y	y	h	30	S
Glen Eden	25.77	146.22	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Valera Vale	25.88	146.27	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Kookaburra	25.92	149.78	*I. schimperi*	y	y	y	2	2	s	h	y	y	y	h	80	I
Belcrest (Wandoan)	26	149.9	*I. schimperi*	y	y	y	2	1	o	g,h	y	y	y	n	0	sus. N
Rolfe Park	26.38	148.77	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Norton	26.39	148.76	*I. schimperi*		y	y	1	1	i	g	n	n	n	n	0	?
Charleville laboratory	26.41	146.24	*A. angustissima*				sus. 2	sus. 0		g	sus. N	sus. N	sus. N	NA	NA	suspected clean
Holyrood	26.49	148.45	*I. schimperi*	y	y	y	1	1	i	g,h	y	y	y	n	0	S
Bindaroo (Roma)	26.67	149.03	*I. schimperi*	y			1	0	n5	c	y	y	y	c	100	suspected clean
Sunset Downs (Tara)	27.28	150.25	*I. schimperi*	y	y	y	1	1	o,n1	h	y	y	y	n	0	almost clean
Ellenvale	26.73	150.72	*I. schimperi*	y	y	y	1	1	i	g,h	?	y (marke	g	n	100	? New owners
Lyndon Caves	26.83	148.94	*A. angustissima*		y	y	1	0	n1	g	NA	NA	NA	NA	NA	S
Warrill View	27.5	152.4	*A. angustissima*	y	y	y	1	2	f	g,h	n	y	y	n	0	?
Glenbower (Pittsworth)	27.84	151.58	*I. schimperi*	y	y	y	1	1	n1	c,h	y	y	y	n	0	S
Ula Ula	28.02	149.42	*I. schimperi*		y		1	0	n5	g	NA	NA	NA	NA	NA	S
Bringalily	28.09	151.17	*I. schimperi*		y		1	0	n5	g	NA	NA	NA	NA	NA	S
Kindon	28.09	150.78	*I. schimperi*	y	y	y	1	1	n1	g,h	y	y	y	n	0	S
Boongargil (Toobeah)	28.53	149.67	*I. schimperi*	y	y	y	1	0	n1	c,h	y	y	y	n	0	S,I
Valencia			*I. schimperi*	y	y	y	1	1	i	g/h	y	y	y	n	0	S

9.14 Activities undertaken by DAFF staff to control Aeschynomene paniculata at 'Batavia Downs' and 'Sudleigh'.

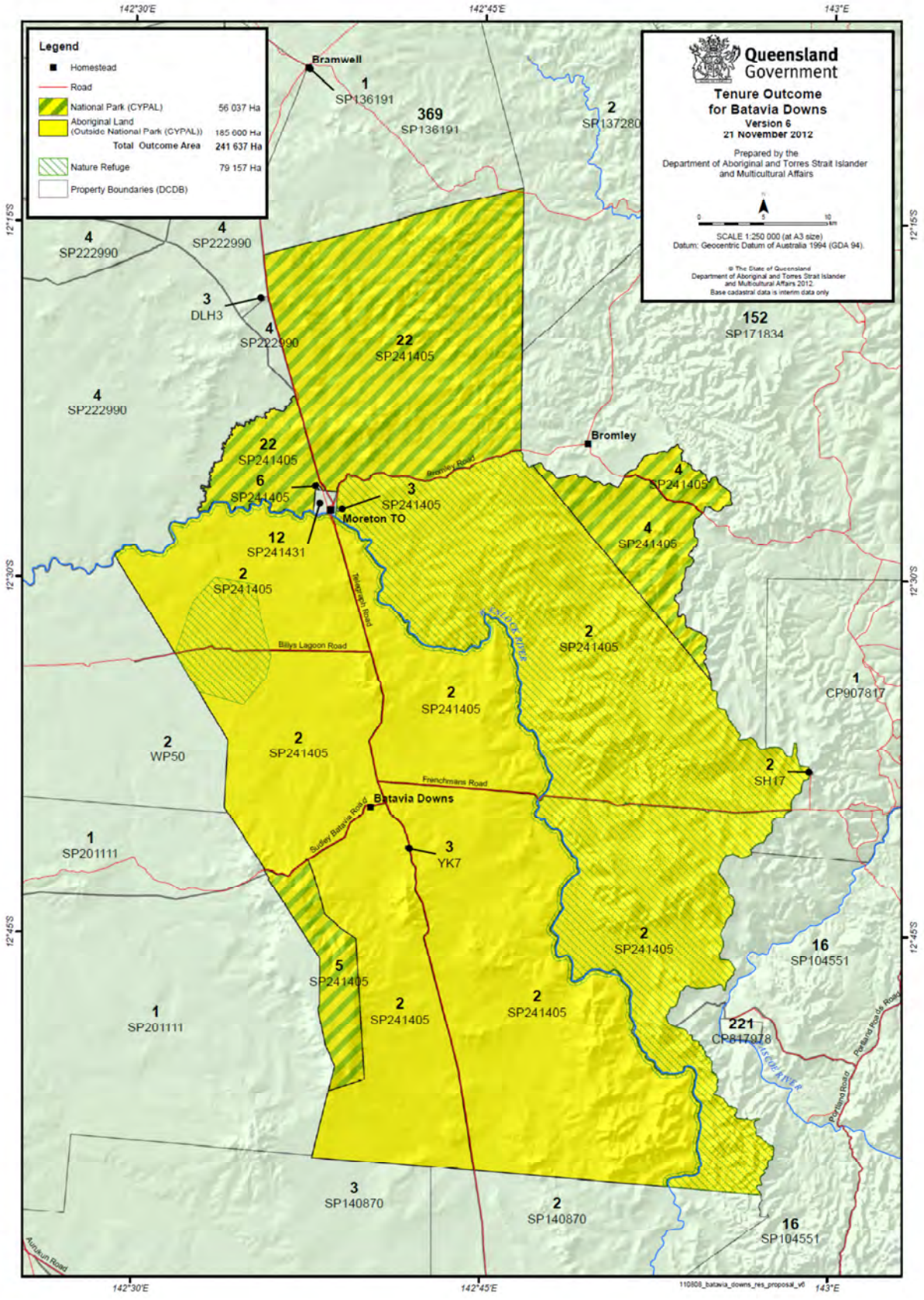
Visit dates	Site(s)	Officers	Activities completed (remove innapropriate)	Details			Officer work time (hrs)	Work time (%)		Number of patches		Smallest patch	Largest patch	Most patches	Comments	Actions required
								Project	Local							
19-04-11 to 21-04-11	Sudley	SD GR and owners	Surveys and mapping	Foot survey, no mapping	No GPS points logged	1 km 5 points	10	50	50	2	**Dimensions of patch (mxm)**	5*5	10*10		Follow-up on reports from Graham Robertson. Patch on roadside, near gate.	visit and survey the roadside in each direction from core site
			Treating plants	Plants hand-pulled	Herbicide applied (total mixed product): (xx L)	Grazon DS 30 litres Graslan 100grams		50	50		**Estimated number of plants**	1000	2500			
			Staff familiarisation and training	Property owner shown plant for future identification purposes	Number of staff:	1 plus owner and caretaker (GR)					**Seeding plants (%)**	5				
											Estimated number of plants (calc)	3500				
19-04-11 to 21-04-11	Schilling airstrip and Lydia boundaries	KC ST	Surveys and mapping	None	No GPS points logged		10	100		Not measured	**Dimensions of patch (mxm)**					revisit as required
			Treating plants	plants also hand pulled and seed collected lot of patches and individual plants on boundaries	Herbicide applied (total mixed product): (xx L)			100			**Estimated number of plants**					
			Staff familiarisation and training	DERM staff shown infested areas	Number of staff:	2					**Seeding plants (%)**					
			equipment maintainence	General							**Estimated number of plants (calc)**	2000				
23-05-11 to 28-05-11	Pound Schilling and Lagoon paddock outliers	MK SD	Surveys and mapping	did paddock outliers and marked new points	No GPS points logged		64	100			**Dimensions of patch (mxm)**					revisit as required
			Treating plants	plants hand pulled and seed collected at all known GPS points	Herbicide applied (total mixed product): (xx L)			100			**Estimated number of plants**					
			Staff familiarisation and training		Number of staff:	2					**Seeding plants (%)**					
			equipment maintainence	checked over bikes							**Estimated number of plants (calc)**	10000				
15-08-11 to 19-08-11	Airstrip Lydia and Lagoon GPS points also surveyed paddock in front od schilling dubbed (dollar)	MK SD	Surveys and mapping	did paddock outliers	No GPS points logged	Did not measure	48	100		80	**Dimensions of patch (mxm)**			3		revisit as required
			Treating plants	plants hand pulled and seed collected at all known GPS points	Herbicide applied (total mixed product): (xx L)			100			**Estimated number of plants**			50		
			Staff familiarisation and training	no	Number of staff:	2					**Seeding plants (%)**			80		
			equipment maintainence	checked over bikes and got them working							**Estimated number of plants (calc)**	4000				
21-11-11 to 24-11-11	Pound and Lagoon GPS points	MK SD	Surveys and mapping	did paddock outliers. Went to marked points and added new ones as they occurred.	No GPS points logged		32	100		70	**Dimensions of patch (mxm)**				storm of 75mm 3 weeks prior to visit however no germination of new seedlings was evident	revisit as required
			Treating plants	plants hand pulled and seed collected at all known GPS points	Herbicide applied (total mixed product): (xx L)			100			**Estimated number of plants**			10	plants hard to detect so trip was cut short	
			Staff familiarisation and training	no	Number of staff:	2					**Seeding plants (%)**					
			equipment maintainence	checked over bikes and got them working							**Estimated number of plants (calc)**	700				
12-03-12 to 13-03-12	Visited all outliers on roadsides north south east and west	MK SD and DERM staff	Surveys and mapping	Quad-bike survey of outliers (quick)	No GPS points logged		16	100		10	**Dimensions of patch (mxm)**					revisit as required
			Treating plants	plants hand pulled and seed collected at known GPS points	Herbicide applied (total mixed product): (xx L)			100			**Estimated number of plants**			20	charter flight with DERM to check over bikes	
			Staff familiarisation and training	no	Number of staff:	2					**Seeding plants (%)**				plants maturing earlier in season as large December rainfall	
			equipment maintainence	checked over bikes and got them working							**Estimated number of plants (calc)**	200				

Visit dates	Site(s)	Officers	Activities completed (remove innapropriate)	Details			Officer work time (hrs)	Work time (%)		Number of patches		Smallest patch	Largest patch	Most patches	Comments	Actions required
								Project	Local							
11-05-12 to 12-05-12	Sudley	MK KC	Surveys and mapping	survey roadside 5 kilometres each direction of original detection site on foot	No GPS points logged	5 new points	32	100		5	Dimensions of patch (mxm)	1	10	2		revisit as required
			Treating plants	plants hand pulled and seed collected	Herbicide applied (total mixed product): (xx L)			100			Estimated number of plants	1	200	5		
			Staff familiarisation and training	no	Number of staff:	2					Seeding plants (%)	100	0	60	Mostly seedlings	
			equipment maintainence	no							Estimated number of plants (calc)	220				
13-05-12 to 16-05-12	Lydia 1 2 3 , Airstrip Pound, Rectangle Schilling Lagoon outliers and GPS points	MK KC	Surveys and mapping	yes	No GPS points logged	Total 150 points	80	100		150	Dimensions of patch (mxm)			1		revisit as required
			Treating plants	plants hand pulled and seed collected	Herbicide applied (total mixed product): (xx L)	250 litres grazon		100			Estimated number of plants			20		
			Staff familiarisation and training	no	Number of staff:	2					Seeding plants (%)	100		60		
			equipment maintainence	yes							Estimated number of plants (calc)	3000				
12.06-12 to 17 06-12	Lagoon treat marked points and survey paddock	MK KC	Surveys and mapping	yes	No GPS points logged	Total 130 points	73	100		130	Dimensions of patch (mxm)	1	50	2		revisit as required
			Treating plants	plants hand pulled and seed collected and seedlings treated	Herbicide applied (total mixed product): (xx L)	120 litres grazon		100			Estimated number of plants	1	200	20		
			Staff familiarisation and training	yes. Staff member on-site with project officers.	Number of staff:	2					Seeding plants (%)	100	60	60		
			equipment maintainence	yes. Fitted new spray tanks and serviced quadbikes.							Estimated number of plants (calc)	2600				
6.05.13 to 10.05.13	Sudley	MK	Surveys and mapping	retruned to GPS points	No GPS points logged	none new	2	100		5	Dimensions of patch (mxm)	1	4	2		revisit as required. Excellent progress to date.
			Treating plants	plants hand pulled and seed collected. Grazon DS plus wetter at label rates applied with a hand-sprayer	Herbicide applied (total mixed product): (xx L)	0.5		100			Estimated number of plants	1	10	5		
			Staff familiarisation and training	no	Number of staff:	1					Seeding plants (%)	100	0	60	All seedl;ings	
			equipment maintainence	no							Estimated number of plants (calc)	30				
6.05.13 to 10.05.13	Visited all outliers on roadsides north south east and west	MK	Surveys and mapping	Quad-bike survey of outliers (quick)	No GPS points logged		10	100		10	Dimensions of patch (mxm)					revisit as required
			Treating plants	plants hand pulled and seed collected at known GPS points. Also used Grazon-DS plus wetter applied at label rates (quad).	Herbicide applied (total mixed product): (xx L)	15		70	30		Estimated number of plants			20		
			Staff familiarisation and training	no	Number of staff:	1					Seeding plants (%)			70	hand-stripped and pulled plants	
			equipment maintainence	checked over bikes and got them working							Estimated number of plants (calc)	200			no plants found in new bitumin stip area (eastern side of road).	
6.05.13 to 10.05.13	Fencelines: Lydia 1 2 3 , Airstrip Pound, Schilling, Laggon (back fence+ large patch). Airstrip ridge Dense patch in Lagoon.	MK	Surveys and mapping	no, but a few new points marked	No GPS points logged	Total 150 points	16			80	Dimensions of patch (mxm)	1	1600	5		revisit this year
			Treating plants	Grazon-DS plus wetter at label rates. Plants hand pulled and seed collected	Herbicide applied (total mixed product): (xx L)	300 litres grazon (mostly in Lagoon)		80	20		Estimated number of plants	1	20000 (seedlings in lagoon patch)	15	Graslan may have worn off in Lagoon patch. Improvement in repeat treat areas	
			Staff familiarisation and training	yes	Number of staff:	2					Seeding plants (%)	100		60		
			equipment maintainence	yes							Estimated number of plants (calc)	1200				

Visit dates	Site(s)	Officers	Activities completed (remove innapropriate)	Details			Officer work time (hrs)	Work time (%)		Number of patches		Smallest patch	Largest patch	Most patches	Comments	Actions required
								Project	Local							
28.06.13 to 3.07.13	Lagoon treat marked points and survey paddock	MK KC	Surveys and mapping	yes	No GPS points logged	~70 new points	60	100		200	**Dimensions of patch (mxm)**	1	50	2		revisit as required
			Treating plants	plants hand pulled and seed collected and seedlings treated	Herbicide applied (total mixed product): (xx L)	180 litres Grazon		100			**Estimated number of plants**	1	500	20		
			Staff familiarisation and training	yes. Staff member on-site with project officers.	Number of staff:	2					**Seeding plants (%)**	100	60	60		
			equipment maintainence	yes. Fitted new spray tanks and serviced quadbikes.							**Estimated number of plants (calc)**	4000				
02.07.13	Pound (and nearby roadways)	MK KC	Surveys and mapping	did paddock outliers. Went to marked points and added new ones as they occurred.	No GPS points logged	6	6	100		20	**Dimensions of patch (mxm)**				Effective detection and treatment.	revisit as required
			Treating plants	plants hand pulled and seed collected at all known GPS points	Herbicide applied (total mixed product): (xx L)	1L		100			**Estimated number of plants**			10		
			Staff familiarisation and training	no	Number of staff:	2					**Seeding plants (%)**					
			equipment maintainence	checked over bikes and got them working							**Estimated number of plants (calc)**	200				
27.05.14 to 1.06.14	Fencelines: Lydia 1 2 3 , Airstrip edge, Schilling (back fence). Wenlock paddock and highways.	MK+KC	Surveys and mapping	checked known spots + entire runs (extended on previous)	No GPS points logged	Total 76 new points	32			120	**Dimensions of patch (mxm)**	1	1600	5		revisit during/following 2014-15 wet season
			Treating plants	Grazon-DS plus wetter at label rates. Plants hand pulled and seed collected	Herbicide applied (total mixed product): (xx L)	150 litres grazon (mostly in Lagoon)		80	20		**Estimated number of plants**	1	20000 (seedlings in lagoon patch)	10	Plant numbers declining at many patches but some new patches	
			Staff familiarisation and training	yes	Number of staff:	2					**Seeding plants (%)**	100	60	60		
			equipment maintainence	yes							**Estimated number of plants (calc)**	1200				
27.05.14 to 1.06.14	Lagoon treat marked points and survey paddock	MK KC	Surveys and mapping	yes	No GPS points logged	70 new points	32	100		135	**Dimensions of patch (mxm)**	1	100	2		revisit during/following 2014-15 wet season
			Treating plants	plants hand pulled and seed collected and seedlings treated	Herbicide applied (total mixed product): (xx L)	150 litres Grazon		100			**Estimated number of plants**	1	1000	15	Plant numbers declining but some new patches in new areas	
			Staff familiarisation and training	yes. Staff member on-site with project officers.	Number of staff:	2					**Seeding plants (%)**	100	60	60		
			equipment maintainence	yes. Fitted new spray tanks and serviced quadbikes.							**Estimated number of plants (calc)**	2025				
27.05.14 to 1.06.14	Pound (and nearby roadways)	MK KC	Surveys and mapping	Went to marked points and added new ones as they occurred. Checked lick area.	No GPS points logged	3 new points	8	100		15	**Dimensions of patch (mxm)**	1	5	3	Plants numbers declining. New patch near lick.	revisit during/following 2014-15 wet season
			Treating plants	Plants hand pulled and seed collected at all known GPS points	Herbicide applied (total mixed product): (xx L)	1L		100			**Estimated number of plants**	1	10	5		
			Staff familiarisation and training	no	Number of staff:	2					**Seeding plants (%)**					
			equipment maintainence	no							**Estimated number of plants (calc)**	75				
27.05.14 to 1.06.14	Sudley + patch on Sudleigh boundary	MK	Surveys and mapping	Return to all logged points	No GPS points logged	No new points	4	100		18	**Dimensions of patch (mxm)**	1	2	1	Effective detection and treatment.	revisit next few months as follow-up
			Treating plants	plants hand pulled and seed collected at all known GPS points	Herbicide applied (total mixed product): (xx L)	1L		100			**Estimated number of plants**	1	100 (seedlings)	5		
			Staff familiarisation and training	no	Number of staff:	2					**Seeding plants (%)**					
			equipment maintainence	no							**Estimated number of plants (calc)**	90				

Visit dates	Site(s)	Officers	Activities completed (remove innapropriate)	Details			Officer work time (hrs)	Work time (%)		Number of patches		Smallest patch	Largest patch	Most patches	Comments	Actions required
								Project	Local							
12-14.07.14	Lagoon treat marked points and survey paddock	MK KC	Surveys and mapping	yes	No GPS points logged	36 new points	32	100		66	**Dimensions of patch (mxm)**	1	100	2		revisit during/following 2014-15 wet season
			Treating plants	plants hand pulled and seed collected and seedlings treated	Herbicide applied (total mixed product): (xx L)	180 litres Grazon		100			**Estimated number of plants**	1	500	20	Plant numbers declining but some new patches in new areas	
			Staff familiarisation and training	yes. Staff member on-site with project officers.	Number of staff:	2					**Seeding plants (%)**	100	60	60		
			equipment maintainence	yes. Fitted new spray tanks and serviced quadbikes.							**Estimated number of plants (calc)**	1320				
14.07.14	Sudley	MK KC	Surveys and mapping	Return to all logged points	No GPS points logged	No new points	6	100		8	**Dimensions of patch (mxm)**	1	2	1		revisit after significant rainfall
			Treating plants	plants hand pulled and seed collected at all known GPS points	Herbicide applied (total mixed product): (xx L)	2L		100			**Estimated number of plants**	1	10	5		
			Staff familiarisation and training	no	Number of staff:	2					**Seeding plants (%)**					
			equipment maintainence	no							**Estimated number of plants (calc)**	40				

9.15 Distribution of land class at Batavia Downs following ownership transfer in November 2012.



9.16 Recommended actions for the containment and control of *Aeschynomene paniculata*) at Batavia Downs, September 2012.

Background

The recommendations presented here for the management of panicle jointvetch (PJV) at Batavia Downs follows a meeting between Rebecca Clear (DATSIMA), Kendrick Cox and Mark Keating (both DAFF) on 14 September 2012. The intention is to outline recommended actions of various parties towards the control of PJV at Batavia Downs during 2012-13 and 2013-14 seasons, in the first instance, although these principles apply to longer-term control. In preparing these recommendations, it is recognised that:

1. PJV is not a Declared Plant in Queensland, but is an unpalatable contaminant of pastures which can dominate grasslands on Batavia Downs. Batavia Downs contains (by some margin) the largest population of PJV in Australia.
2. The areas of Batavia Downs which are known to contain PJV will be transferred from Queensland Government ownership to the Batavia Downs Aboriginal Corporation on 21 November 2012.
3. Certain portions of Batavia Downs will become nature reserves and national parks, and there is interest by the Queensland Government in keeping PJV out of these areas. The Queensland Government and the Batavia Downs Aboriginal Corporation will preside on a board to oversee management of these areas.
4. Meat and Livestock Australia and DAFF co-fund a project targeting the containment and reduction of plant populations of PJV within Queensland. Through this project, DAFF staff can continue to contribute to the containment and control of PJV at Batavia Downs until the scheduled end of the project on 31 July 2014.
5. DATSIMA, transfer of property arrangements will contribute funding towards the containment and control of Batavia Downs during the 2012-13 and 2013-14 growing seasons.
6. DAFF staff have completed weed surveying and control of PJV at Batavia Downs since 1999. Some assistance in control has been provided by the caretakers, Graham and Karen Robinson.
7. In the last two years, control of PJV in ‘core’ areas has been (mostly) completed by locally employed staff supervised by Graham and Karen Robinson using funding sourced by (then) DERM. DAFF staff, through the MLA/DAFF project, have concentrated on outlier populations and surveying.
8. It is believed Graham and Karen Robinson will be granted a 5-year lease, by the Batavia Downs Aboriginal Corporation, allowing them to continue to raise cattle on Batavia Downs, including areas containing PJV.
9. PJV appears to spread through stock movement, via ingestion of seed and passage through the gut, and on vehicles. Evidence for this is based on proximity of plants to cattle pads and camps and vehicle access areas.
10. PJV seeds prolifically and seeds exhibit a high level of hardseed dormancy, which means seeds can remain viable in soils for 5+ years. Seed dormancy can be overcome through the use of fire.

Recommended activities for the control of PJV, 2012-14.

a. Monitoring and chemical control of PJV

Activity	Time-frame	Completed by	Estimated effort
First round spraying of PJV with Grazon-DS plus wetter and dye marker in core areas, namely: • Original sown paddock (ha) plus laneway and neighbouring paddock • Yards and small paddocks to the east • Ridges paddock • Horse paddock • Bull paddock • Lydia 1 • Schilling paddock • Airstrip paddock to the west of Lydia Creek • Rectangle paddock • Lagoon paddock between the northern fenceline and the first creek	March-May as rainfall allows	Officers employed by DATSIMA, with supervision by G&K Robinson and occasional assistance by DAFF staff	Two officers for 40 days each
Second round spraying of PJV in core areas (see above) and removal and destroying of seeds. Hand-pull isolated plants.	June-July	Officers employed by DATSIMA, with supervision by G&K Robinson and occasional assistance by DAFF staff	Two officers for 30 days each
Control, through spraying and hand-pulling plants and removing seeds, and GPS marking of PJV in outlier areas, including: • Fence-lines (and 10 m inside) of paddocks along the Peninsular Development Road, including Airstrip, Lydia 1, Lydia 2, Lydia 3 and Wenlock paddocks • Fence-lines (and 10 m inside) of paddocks along the east-west road to Weipa, including Airstrip, Schilling, Trial, Rectangle and Spring paddocks • Isolated patch on the western boundary of Batavia Downs • Airstrip paddock to the east of Lydia Creek • Trial paddock • Lagoon paddock to the south of the creek parallel to the northern fence line • Lydia 2 • Lydia 3	March-May	DAFF staff with occasional assistance from officers employed by DATSIMA	Two officers for 15 days each
GPS surveying and treatment, as above, of found plants in: • Lagoon paddock (2013) • Trial paddock, particularly northern fence line (2014)	April-June	DAFF staff with occasional assistance from officers employed by DATSIMA	Two officers for 7 days
Official training of new officers in the application of herbicides and operation of quad bikes as required with staff changes	When required	Suitably qualified training	Depends on course

		provider funded by DATSIMA	
Familiarisation of new officers in the identification and location of PJV, best treatment methods and maintenance of equipment	When required	DAFF with assistance by G&K Robinson	Two officers one day

b. Strategic spelling and quarantining of stock and use of fire

Activity	**Time-frame**	**Completed by**	**Estimated effort**
Where fencing and watering allow, remove livestock from the following paddocks: • Lydia 1 • Airstrip • Schilling • Lagoon • Rectangle If these paddocks are required for grazing, they should only be grazed when PJV is not seeding.	Best to de-stock March to August	G&K Robinson	As required for a mustering gang, possibly 4 people for 2 days
Stock moving from contaminated paddocks to clean paddocks, or off station, should be held in the yards for 5-7 days to allow passage of seeds through the gut.	When seeding, March to August	G&K Robinson	As required to water and feed stock in yards and source hay
Complete a late dry-season burn, as conditions allow for safe burning, of one infested paddock per year, to be followed-up with thorough herbicide control of seedlings following early wet-season rainfall. Recommended paddocks include: • Lydia 1 • Schilling • Airstrip • Rectangle • Lagoon (after surveying)	After first storm, possibly October-November	G&K Robinson	2-3 officers for 1 day

c. Supply and maintenance of equipment

Activity	**Time-frame**	**Completed by**	**Estimated cost ($)**
Supply of the following: • 2 x quad bikes fitted with spray-tanks • Herbicide, wetter and spray marker • Safety equipment for mixing chemical • First-aid kits for quad-bikes • Freight (if required)	On-going	DAFF	 $1000 pa lease $2000 pa $100 pa $100 pa $500 pa
Supply of fuel for quad-bikes so it is available for use by DATSIMA employed staff and DAFF staff	On-going	G&K Robinson supply fuel and invoice DAFF	$300 pa
Supply of the following: • Personal safety equipment for spraying including suitable clothing, boots, hats, respirators, gloves, insect repellent etc	On-going	DATSIMA	For DATSIMA to determine
Annual servicing of quad-bikes and spray equipment	Before wet season	DAFF	$400 materials plus officer time
Regular checking and maintenance of quadbikes and sprayers, including checking oil, operation of fans, cleaning filters on hand-guns	Regular	Officers employed by DATSIMA	No particular cost, ~1 hr per week per bike

Supply of accommodation[1] for DATSIMA employed officers	February-September	G&K Robinson	Unknown
Supply of accommodation[1] for DAFF staff when visiting, preferably the demountable building previously erected by DAFF	March - August and December as required	G&K Robinson	Unknown

[1] including access to a shower and toilet

Kendrick Cox (Senior Scientist, DAFF) and Mark Keating (Senior Technical Officer, DAFF)
20 September 2012

9.17 Pest management plan for controlling Aeschynomene paniculata at 'Batavia Downs'. Annexure to the transfer of ownership agreement between the Queensland Government and the Batavia Indigenous Corporation.

Management Plan for the control of Pannicle Jointvetch (*Aeschynomene paniculata)* on Batavia Downs station

1. Description

Pannicle Jointvetch (*Aeschynomene paniculata)* (PJV) is a plant introduced from Central and South America as a potential pasture species. Research conducted on Batavia Downs Station (Batavia) and other properties around Queensland found PJV was incompatible with stock and rarely eaten. The plant however tends to dominate more productive pasture species. Control of the trial plantings commenced in the late 1990s. The species was nationally recognised as a sleeper weed in 2002. If PJV is not contained it is likely to take over valuable pastures in many areas of northern Australia.

PJV is a perennial shrub legume that germinates through the wet season and produces mature seed by early April. Plants are easily identified in the active growing stages due to the distinct teal coloured leaves. Seeding plants can be reliably distinguished from native vegetation by a trained person, but are still easily missed even by experts. For this reason multiple passes through infested areas need to be made to ensure missed plants are found and destroyed. Plants missed from one season to the next will be able to rapidly produce and drop mature seeds after first rain, even before control works begin. If this happens, the seed could survive up to seven years effectively putting control efforts back by the same period.

Pannicle Jointvetch

2. Containment Plan

This management plan is intended to continue to contain PJV to its current extent on Batavia Downs station and reduce plant populations over time. It is unlikely to achieve eradication, which would however be feasible with additional actions outlined in Attachment 1.

2.1 Objectives

1. Locate and treat plants of PJV at Batavia so that plants are killed and seeding is prevented on an annual basis.
2. Prevent spread of PJV into grasslands surrounding Batavia Downs station.
3. Develop the local capacity to control PJV at Batavia Downs station.

2.2 Control Timing and Methodology

Wet Season

Chemical control is to commence on actively growing plants each season after the first rains and is to be continued until the plants stop actively growing and start losing leaf. Plants have distinctive blue foliage when actively growing. Plants are sprayed with a broad leaf herbicide such as Grazon DS during or after the wet season. Grazon DS should be applied at a rate of 340 parts water to 1 part herbicide or 3 millilitres/litre of water. A non-ionic wetter (BS-1000 or similar) should be added at a rate of 60 millilitres BS-1000 to 100 litres of water. A spray marker dye is recommended, applying sufficient herbicide over the blue/green portions of the plant until the colour is detectable. Herbicide should not be applied to run-off as these rates are wasteful and can damage surrounding plants. Surrounding grasses can tolerate low doses of Grazon DS enabling them to compete with germinating seedlings later in the season.

The optimum time to treat PJV is February through to April, during vegetative growth and early flowering. Controlling PJV for at least 10 days per month is to be achieved in this period. Exact timing for control will depend on weather conditions and access.

Rest of the year

Mechanical control (hand pulling etc) can be performed all year and is very effective as a method of control in follow up strikes with limited numbers of plants. Hand pulling of seeding plants should commence as seed is produced and should continue until no plants are found in known infestations. Spraying will not kill seed once it is more than partially developed. Hand removal, bagging and destruction (burning) of seed will help reduce the seed bank for the following year. Control of plants is to be performed for an average of 4 days per fortnight between May and September.

Burning of areas containing larger populations of PJV can be very effective at encouraging seed germination and, therefore, erosion of soil-seed banks. This will only work if follow-up control of emerging plants is effective (See Attachment 1).

Note: Control works should always be repeated several times in each area each year to ensure that no plants produce mature seed or that no seed reaches the seed bank for future years.

2.3 Search pattern

1. Initially, treat plants along roads and tracks to limit spread of seed via machinery.
2. Use spray paint on trees to mark up search grids over known infestations to break up search areas into manageable sections i.e. 200m x 200m. Search each block at 5-20m transect spacing depending on visibility. If plants are found intensify search effort around each point for a radius of 50m.

Specifically, the areas known to contain PJV are:

1. Frequent patches across most of the paddock (core area): Plant site, laneway, yards and yard paddocks, ridges, horse and bull paddock
2. Frequent patches across most of the paddock (nearby paddocks): Schilling, Lydia 1, Rectangle
3. Patches in limited areas of the paddock: Airstrip, Lydia 2, Lagoon and Wenlock paddocks

See map at Attachment 2.

2.4 Weed Hygiene

PJV will not spread without assistance from cattle or vehicles and equipment contamination. For this reason a high priority must be given to the quarantine of PJV through good weed hygiene. Good weed hygiene can be simply achieved by:

- Restricting control activities to quad-bikes if at all possible and keep all other vehicles out of infested areas.
- Washing down quad bikes (and other vehicles if used) after they have left densely infested areas and before they enter areas with low plant populations.
- Thoroughly washing down bikes and other vehicles before they leave the property.
- Ensuring seeds do not get caught in clothes (in folds, boots and pockets) or bikes while collecting seed before hand removal
- Destocking heavily infested areas is recommended. It is strongly recommended that animals be kept out of the following paddocks or areas: core area, Schilling, Airstrip, Rectangle and Lydia 1. It is also desirable to prevent stock access to Lagoon paddock. If stock are kept in infested paddocks, they should be yarded for 5-7days after removal from infested paddocks, allowing viable seed to pass through the gut and be contained in an area where seedlings can be effectively treated.

2.5 Reporting

A GPS should be used to record tracks made in the core infestation and each patch of plants and tracks made should be recorded by GPS in the other areas outside the core area to monitor the success of the control program, plan future works and apply for future funding. GPS files can also be used effectively as timesheets.

In addition to the GPS point and track data, a daily log of spray volume and hours worked is to be recorded and copied to DEEDI and DERM.

2.6 Training and assistance

DERM and DEEDI will provide the following support in the first 2 years, and will use their best endeavours to provide similar support in subsequent years.

DERM will provide funding for two people to work for:

- 30 days each on PJV control between February and April
- 40 days each on PJV control between May and September

The Batavia caretaker will provide:

- for the two people to be housed in the workers' quarters at Batavia Downs;.

- for quads, equipment and chemical to be stored in sheds and ensure these are used solely for PJV control. These quads must not be used or moved outside the PJV infested area.

DEEDI will provide the equipment listed below and site-specific operational training in familiarisation with the plant, distribution and equipment. When DEEDI staff are on site they will provide guidance and support for the PJV control staff. At other times the on-site supervisor will provide technical advice to the PJV control staff and act as contact to departmental staff.

2.7 Provision of equipment and facilities

Supplier	Equipment and facilities
DEEDI	2 quad bikes mounted with suitable spray tanks Safety helmets
	Herbicide, wetter and dye-marker and mixing equipment
	Hand-held GPS unit (1 between 2)
	Miscellaneous supplies for the above (batteries)
DERM	Wages administration costs and safety equipment costs
Batavia caretaker	Housing for 2 workers

Attachment 1

Strategic use of fire

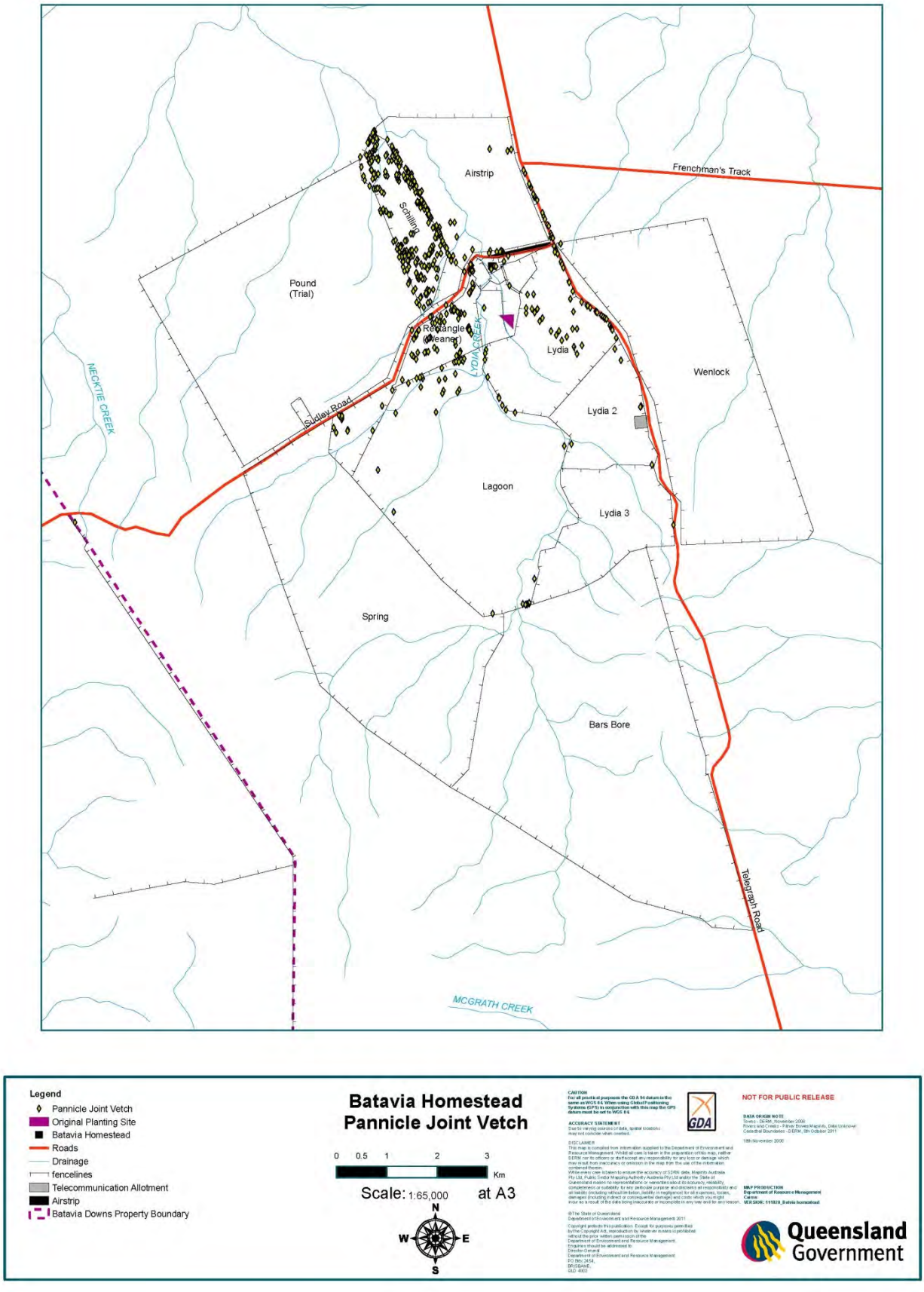
To give the best possibility to eradicate PJV the infestation area should be de-stocked to allow grass to build up. Treated areas could then be burnt to further reduce the seed bank, through reducing seed dormancy and encouraging germination.

A buffer around the paddocks could be burnt early in the season creating a fire break for later in the season. After each paddock has been treated for the second time the area should be burnt as hot as possible to kill missed plants. These fires will be held up by the burnt breaks. Neighbouring paddocks should be searched for new infestations and these areas included in the annual treatment areas.

The following year the buffers to the infested paddocks should be burnt early. Infested areas should then be searched and plants treated first on quad bike and then follow up should be done on foot leaving the bikes at one end of the paddock. Plants found would then be hand pulled and any seed removed and destroyed. Each area ideally would be searched several times on foot. This time the area should not be burnt to allow fuel build up for the following year. The fire breaks would stop wildfires burning the fuel loads. Year 3 would be similar to year 1.

This cycle should be repeated until no plants are found for 5 years, with less frequent checks thereafter.

Attachment 2



9.18 Recommended actions for the containment and control of panicle jointvetch (*Aeschynomene paniculata*) at Strathmay.

Background

1. PJV is not a Declared Plant in Queensland, but is an aggressive, unpalatable, environmental weed which can dominate grasslands and woodlands in Northern Australia. There are only a small number of known infestations of PJV in Australia.
2. The areas of Strathmay which are known to contain PJV will be transferred from Queensland State Government ownership to the Olkola Traditional Owners.
3. Strathmay will be transferred to the Traditional Owners as Aboriginal freehold land. Part of the property will have nature refuge status.
4. There is interest by the Queensland State Government to keep PJV out of conservation areas.
5. PJV appears to spread through stock movement, and on vehicles. Evidence for this is based on proximity of plants to cattle pads and licks and vehicle access areas.
6. PJV seeds prolifically and seeds exhibit a high level of hardseed dormancy, which means seeds can remain viable in soils for 5+ years. Seed dormancy can be overcome through the use of fire.

Recommended activities for the control of PJV, 2014-16.

a. Monitoring and chemical control of PJV

Activity	Time-frame	Completed by	Estimated effort
First round spraying of PJV with Grazon-DS plus wetter and dye marker in core areas along the Coleman River as well as paddocks and licks to the east of the homestead.	March-May 2015 as rainfall allows	Staff employed and supervised by Olkola Corp and occasional assistance by DAFF staff	Two staff for 30 days each
Second round spraying of PJV in core areas and removal and destroying of seeds. Hand-pull isolated plants.	June-July 2015	Staff employed and supervised by Olkola Corp and occasional assistance by DAFF staff	Two staff for 40 days each
Control, through spraying and hand-pulling plants and removing seeds, and GPS marking of PJV in outlier areas.	March-May 2016	DAFF staff with assistance from staff employed by Olkola Corp	Two staff for 30 days each
GPS surveying and treatment, as above, of plants found in remaining parts of the property	April-June 2016	DAFF staff with assistance from staff employed by Olkola Corp	Two staff for 40 days
Official training of new staff in the application of herbicides and operation of quad bikes as required with staff changes	When required	DAFF	Two staff one day
Familiarisation of new staff in the identification and location of PJV, best treatment methods and maintenance of equipment	When required	DAFF	Two staff one day

b. Strategic spelling and quarantining of stock and use of fire

Activity	Time-frame	Completed by	Estimated effort
Where fencing and watering allow, remove livestock from the paddocks to the east of the homestead.	Ongoing	Louise Price	
Stock moving through contaminated paddocks to clean paddocks, or off station, should be held in the yards for 5-7 days to allow passage of seeds through the gut.	When seeding, March to August	Louise Price	As required to water and feed stock in yards and source hay
Complete a late dry-season burn, to be followed-up with thorough herbicide control of seedlings following early wet-season rainfall.	After first storm, possibly October-November	Olkola Corp	2-3 staff for 1 day

c. Supply and maintenance of equipment

Activity	Time-frame	Completed by	Estimated cost ($)
Supply of the following: • 2 x quad bikes fitted with spray-tanks • Herbicide, wetter and spray marker • Safety equipment for mixing chemical • First-aid kits for quad-bikes • Freight (if required)	On-going	Olkola funded by DAFF	 $1000 pa lease $2000 pa $100 pa $100 pa $500 pa
Supply of fuel for quad-bikes so it is available for use by Olkola Corp employed staff and DAFF staff	On-going	Olkola Corp supply fuel and invoice DAFF	$300 pa
Supply of the following: • Personal safety equipment for spraying including suitable clothing, boots, hats, respirators, gloves, insect repellent etc	On-going	Olkola Corp and invoice DAFF	For Olkola Corp to determine
Annual servicing of quad-bikes and spray equipment	Before wet season	DAFF	$400 materials plus officer time
Regular checking and maintenance of quad bikes and sprayers, including checking oil, operation of fans, cleaning filters on hand-guns	Regular	Olkola Corp staff	No particular cost, ~1 hr per week per bike
Supply of accommodation[1] for Olkola Corp employed officers	February-September	Louise price	Unknown
Supply of accommodation[1] for DAFF staff when visiting,	March - August and December as required	Louise Price	Unknown

[1] including access to a shower and toilet

9.19 Internal DATSIMA reports of control activities at 'Strathmay' (2014).

Strathmay Panicle Joint-Vetch control works March 2014

By Simon Thompson

Between the 18th and the 21st of March 2014 Ashley Ross, Brendan Ross, Hamish Kulka and Ian McConnell assisted Department of Agriculture, Fisheries and Forestry staff Kendrick Cox and Mark Keating as well as the nature refuge officer Claudia Sauerland and Queensland Parks and Wildlife Staff Craig Dean and Simon Thompson mapping and controlling Panicle Joint-Vetch (*Aeschynomene paniculata*) PJV on Strathmay. The PJV has been found growing north of the Coleman River to the east of the Homestead. This trip was to assess the extent of the infestation and control the plants found.

PJV is a wispy pea flowered legume that is difficult to see. The flowers are yellow with mauve striations and form at the end of branches. Leaves are feather like with a blue green colour. The stems are long and have a reddish tinge. The fruits appear as ovals stacked up on each other. The individual segments can break off when ripe and get carried to new sites. Plants form dense stands over time and in Cape York conditions can out complete most native pastures. There are a couple of other Joint-Vetches that can be mistaken for PJV that grow in the area including American Joint-Vetch (Flowers pink to purple with white, large filaments/bracts at the base of each leaf, mouldy appearance, reddish tinge to new growth, fruit not oval top side flat, not as stalky) and Indian Joint-Vetch (flowers yellow without striations, fruit not oval, top and bottom flat, not as stalky).

Day one concentrated on the high river banks. The first plants were found and Kendrick gave an introductory talk on the identification and history of the plants to the Olkola team. Simon gave quick instructions on the mapping methodology. Plants found were initially hand pulled until the infestation patches became too large for manual control. The larger patches of PJV were controlled using Grazon mixed with water and a red marker. Mark Keating and the Olkola workers wearing knapsacks sprayed from quad bikes while the other participants searched and hand pulled smaller areas.

Day two continued on from the work we did previously. Kendrick, Ian, Craig, Claudia and Simon tried to map the eastern extent of the infestation but flood waters in an anabranch of the Coleman halted progress east. The group hand pulled a large patch and numerous smaller patches and searched some forested country. Plants were most prevalent on higher ground associated with sandy levees on the flood plain. The Olkola crew and Mark Keating continued to spray larges patches along the river.

Day three saw the whole crew, minus Craig, Claudia and Simon, investigating the country to the north of the Long waterhole after plants were spotted on the northern bank. Two large patches were found on the northern side of the waterhole as well as numerous smaller

patches. The large patches were considered by Kendrick to be the source population and one was associated with a lick.

All plants found were treated but follow-up is very important to achieve before the plant seeds. It is proposed that at least two more trips are needed to treat missed plants and further map the extent of the infestation. As the season continues weed hygiene will be paramount. Quad bikes and vehicles are perfect vectors for spreading PJV. Any machine involved in the control needs to be thoroughly cleaned before they are used for other work. Plants were at a flowering and immature fruiting stage this time but on future trips it is likely that fruits will be mature and will therefore need to be bagged and burned at a central site. It will be important to keep stock out of this area so the animals don't spread the weed or reduce fuel loads for burning.

The control of this plant may be ongoing for many years. DAFF has pledged to supply chemical and technical support for this current season. Funding for wages to control PJV is currently unclear. Information will be sent out to relevant groups as details become available.

Strathmay Panicle Joint-Vetch control works April 2014

By Ian McConnell

PJV follow up work , previously treated PJV in background.

Between the 26th and 30th of April 2014 Glenn Kulka,, Hamish Kulka, and Ian McConnell from Olkola Aboriginal Corporation Land Management conducted follow up treatment on Panicle Joint-Vetch , PJV on Strathmay. This trip was to further assess the extent of the infestation, conduct follow up treatment on previous works and treat other infested areas identified but not treated in March.

Morning one concentrated on the high river banks. The initially treated areas were found and Ian gave an introductory talk on the identification of the plants and history of treatment to date to the Olkola team. The larger patches of PJV were controlled using Grazon mixed with water and a red marker. The team sprayed from quad bikes with smaller patches being hand pulled. It was noted that the majority of PJV seed had not set on the riverbank area. Each large patch previously treated had live plants that were shielded by other plants or missed by the team, these were identified and treated.

By mid-afternoon work was begun on previously identified but untreated areas across the Long Waterhole. There were some massive patches here as tall as a person. Day two was all about controlling PJV and joining up with previous works from March. It was noted that the seed had mostly set in the higher areas away from the river .It was quite difficult to

identify the smaller PJV as it was often surrounded by tall grass with light coloured seed heads. Day three was aimed at finishing off identified areas and looking for more infestations. No new areas of PJV were found. The original areas not surveyed in the first paddocks were covered.

Sicklepod was also treated around the infrastructure and along the river flats, late in the afternoons and opportunistically in transit. All plants found were treated.
Quad bikes and vehicles are perfect vectors for spreading PJV. Any machine involved in the control needs to be thoroughly cleaned before they are used for other work. The quads were stripped and cleaned before leaving Strathmay.

PJV as tall as a person.

Quads stripped for weed hygiene.

Some difficulties were encountered with spray equipment, with one unit developing an intermittent short in the pump. This meant it was very unreliable and only worked periodically. We were short on GPS equipment but recorded as best we could. Simons map from the March trip was a great help in making sure everything was covered.

Overall the trip was very successful other than the few equipment hiccups. Obviously further trips will be required into the future to continue the control measures.

9.20 Quick assessments of *Aeschynomene brasiliana* plant populations and level of grazing at selected sites.

Site	Date	Site moisture	Frequency	Growth stage	Monoculture?	Grazed (%)	Companion legumes (grazed %)	Companion grasses
Birralee	28.08.13	Dry	None found	NA	No	NA	Leuleu (100), Dessp. (100)	Cencil, Botper
Braceborough	16.10.14	Dry	Frequent	Had seeded	No	20*	Stysca (20)	Hetcon, Era sp.
Burlington	11.11.12	Dry	Frequent	V+F	No	95+	Stysca (95+)	Hetcon
Burlington	3.4.14	Moist	Frequent	V+F+S	No	0	stysca (0), styham (0), Charot (0)	Botper, Hetcon
Burlington	17.07.14	Dry	Frequent	V+F+S	No	95+	stysca (90), styham (90), Charot (70)	Botper, Hetcon
Carmilla Glen	27.08.13	Dry	None found	NA	No	NA	Stysca (20); Mimpud (0)	Chlgay, Impcyl, Hetcon
Carmilla Glen	27.06.14	Moist	None found	NA	No	NA	Stysca (20); Mimpud (0)	Chlgay, Impcyl, Hetcon
Dalrymple DL	14.10.14	Dry	Frequent	V+F+S	No	No cattle	Not recorded	Thetri, Hetcon
Eungy	28.08.13	Dry	None found	NA	No	NA	Stysca (100)(1 plant)	Botper, Cencil
Galloway Plains	30.01.13	Dry	None found	NA	NA	NA	NA	Botper, Hetcon
Galloway Plains	10.11.11	Dry	None found	NA	NA	NA	NA	Botper, Hetcon
Glensfield	22.05.13	Moist	1 plant (*A. histrix*)	F	No	0	Charot (0), Mimpud (0), Stysca (0)	Chygay, Botsp.
Granite Vale	10.06.11	Dry	Occasional	V+F	No	20	Stysca (10), Charot (0), Aesame (10), Mimpud (0)	Uromos, Hetcon, Chlgay
Granite Vale	24.04.12	Wet	Occasional	V	No	10	Stysca (10), Charot (0), Aesame (10), Mimpud (0)	Uromos, Hetcon, Chlgay
Granite Vale	21.05.13	Wet	Occasional	V+F	No	0	Stysca (10), Charot (0), Aesame (10), Mimpud (0)	Uromos, Hetcon, Chlgay
Lamonds Lagoon	12.11.12	Dry (burnt)	None found	NA	No	NA	Charot	Botper, Hetcon
Lamonds Lagoon	9.4.14	Moist	None found	NA	NA	NA	Charot (0), Stysca (0)	Botper, Uromos, Hetcon
Lamonds Lagoon	17.07.14	Dry	None found	NA	No	NA	Charot (becoming dominant)	Botper, Hetcon
Lynford	22.05.13	Moist	None found	NA	NA	NA	Stysca (50)	Botper, Uromos
Lynford	26.06.14	Moist	None found	NA	NA	NA	Stysca (50)	Botper, Uromos
Narayen	xx.11.11	Dry	None found	NA	NA	NA	NA (Charot present). Site slashed.	Cencil, Chlgay
Narayen	xx.03.12	Dry	None found	NA	NA	NA	NA (Charot dominating). Site slashed.	Cencil, Chlgay
Sorrell Hills	10.11.11	Dry	None found	NA	NA	NA	Desvir, Charot	Hetcon
Springmount	11.09.14	Dry	Occasional	S	No	No cattle	Charot (0); Stysca (0)	Hetcon, Uromos
Strathdale	21.05.13	Moist	Occasional	V+F	No	10	Stysca (20), Charot (0), Aesame (10), Mimpud (0)	Chlgay, Bradec, Hetcon, Setsph
Strathdale	28.08.13	Dry	Occasional	V+F+S	No	50	Stysca (90), Charot (0)	Chlgay, Bradec, Hetcon, Setsph
Sugarbag	11.12.12	Dry	Frequent	V+F	No	95+	Stysca (95+)	Botper, Hetcon
Sugarbag	9.4.14	Drying	Frequent	V+F+S(early)	No, but patches	0	Charot (0), Stysca (0), Chamim (0), Acafar (0)	Botper, Hetcon
Sugarbag	17.07.14	Dry	Frequent	F+S	No	No cattle	Stysca (0)	Botper, Hetcon
Swan's Lagoon	14.03.13	Wet	Frequent	V	No	No cattle	Stysca (0), Charot (0)	Thetri, Hetcon
Swan's Lagoon	14.10.14	Dry	Frequent	V+F+S	No	Frequent	Not recorded	Thetri, Hetcon
Tedlands	20.05.13	Moist	Occasional	F	No	10	Stysca (20), Charot (0), Aesame (10)	Chlgay, Impcyl, Hetcon
Tedlands	27.08.13	Dry	Occasional	V+F	No	50	Stysca (80)	Chlgay, Impcyl, Hetcon
Wadeleigh	30.01.13	Moist	None found	NA	NA	NA	Charot (100), Sty (100)	Botper
Wadeleigh	22.12.14	Drying	None found	NA	NA	NA	Charot (50), Sty (100)	Botper, Dicser, Eragrostis, Hetcon
Walkamin	08.08.13	Dry	Occasional	V	No	95+	Stysca (95+), Charot (30)	Thetri, Hetcon
Walkamin	29.09.14	Dry	Occasional	V	No	No cattle	Stysca (0), Charot (0)	Thetri, Botper

* Dry season spelled

9.21 Information sheets completed in 2014.

Department of Agriculture, Fisheries and Forestry

white-ball Acacia

Acaciella angustissima Willd. ex Vogel
(syn. *Acacia angustissima*, *Acacia boliviana*)

Current situation

White-ball Acacia can form dense, slow-spreading, woody thickets in a range of environments in northern Australia, including native Australian grasslands, sown pastures and riparian areas and roadsides. It is well-adapted to a range of soil types of acid, neutral or slightly alkaline reaction including sandy, loam and clay soils used for grazing in Queensland. Although white-ball Acacia is used to provide fodder in some seasonally dry areas of the world, it is considered of low palatability to livestock compared to other native and introduced legumes in Australia and it can displace more palatable companion vegetation over time. There is some evidence that certain types contain compounds toxic to ruminants. Prolific production of long-lived seeds enables white-ball Acacia to form scattered and dense patches in grasslands.

White-ball Acacia includes a range of forms variously found in tropical areas of north, central and south America, where it is best adapted to seasonally dry areas. Ecotypes were introduced and small (mostly < 1 ha) experimental plots established in inland, sub-coastal and coastal areas in north, central and south Queensland between the mid-1970s and mid-1990s to assess value for livestock production. It has proven particularly well-adapted to coastal and sub-coastal areas, but also survives in dry inland areas. White-ball Acacia was rejected for further development because of low acceptability by livestock in Queensland.

A 15-year monitoring and control program conducted by the Queensland Government, with assistance from staff of CSIRO and JCU and co-funding from the Beef Industry, began in 1999 to minimise any impact white-ball Acacia may have on pastures and grasslands. White-ball Acacia is limited to small (all but one less than 1 ha), mostly scattered populations in close proximity to the original plant evaluation sites plus a few small sites where naturalised populations were found (history of sowing unknown). Long-lived seed in soil means that plants are expected to emerge over the next 5–10 years depending on the levels of viable seeds in soil.

Great state. Great opportunity.

Description

White-ball Acacia is highly variable and a number of forms are present at some sites. It is a perennial, erect, thornless shrub or small tree usually 2–7 m (to 12 m) tall. Some forms have hairs on newly-formed branches, but the most common form does not. The trunk and branches have distinct lateral striations on the dark-brown bark. The bipinnate leaves are usually 10–21 cm long and have 10–17 pairs of pinnae. The pinnae are 2.5–5 cm long and each bears 20–40 pairs of leaflets (2.4–5 mm long and 0.5–3 mm wide). Leaves are retained well into the dry season. The flowers are small (1–1.5 cm across), roundish clusters of white florets on short stalks. The flower clusters are borne on terminal inflorescences formed from various combinations of branching. The flat, thin-walled, papery pods are borne in clusters and are 3–9 cm long and 6–15 mm wide with straight or curved margins. The shape of the seeds is prominent through the coat of the seed pod. Each pod contains 8–12 circular/ovoid dark-brown seeds 2.5–3.2 mm across.

White-ball Acacia plants may be confused with leucaena (*Leucaena leucocephala*), a tree legume used for fodder in similar environments. Key differences are that leucaena has longer (14–16 cm), less papery pods and the bark is grey and does not have striations.

Reproduction and dispersal

White-ball Acacia can flower in the first year after establishment under favourable growing conditions. Thereafter mature plants can flower whenever there is sufficient moisture and temperature for prolonged growth. In north Queensland, for example, flowering of mature plants is often observed during May–June following summer (monsoonal) rainfall. Mature seed is produced within two months of flowering. The seed pods do not violently shatter, and seeds fall close to the plant forming extensive seed banks. A large proportion (over 80%) of mature white-ball Acacia seed has hardseed dormancy and some of this seed expected to survive at least five years in soil.

Seeds are the principal form of dispersal, although plants can slowly spread vegetatively via root 'suckering'. The seeds can be dispersed by machinery or slowly move down-slope following heavy rainfall. Although the plant has low palatability, livestock may occasionally eat seed pods. A small proportion of seeds are known to survive the ruminant gut (study with sheep).

Table 1: Herbicides[1] for controlling white-ball Acacia.

Method	Herbicide	Rate	Registration Status
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) e.g. Conquerer®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	Registered Australia wide for the control of wattle (*Acacia spp.*)
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) + 8 g/L aminopyralid) e.g. Grazon Extra®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	Registered Australia wide for the control of wattle (*Acacia spp.*)
Basal bark	triclopyr (240 g/L) + picloram (120 g/L) e.g. Access®	• 1 L/60 L diesel	Registered Australia wide for the control of Acacia species
Cut and paint	triclopyr (240 g/L) + picloram (120 g/L) e.g. Access®	• 1 L/60 L diesel	Registered for Acacia species
Cut stump	picloram (43 g/kg) e.g. Vigilant®	• Apply 3–5 mm thick over the cut surface (< 20 mm in diameter) • Apply 5 mm thick over the cut surface (> 20 mm in diameter) • In multi-stem plant treat at least 80% of stems	Registered for woody weeds

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

[1] There is no herbicide currently registered for control of white-ball Acacia in Queensland; however, an off-label use permit (Permit No. 11463) allows the use of various herbicides for the control of environmental weeds in non-agricultural areas, bushland, forests, wetlands, and coastal and adjacent areas.

Table 1 includes treatment options allowed by the permit. It is important to note that specific research on the use of herbicides to control white-ball Acacia has not been undertaken to date. Therefore, the treatment options outlined in Table 1 are suggestions only, based on registered controls for similar weeds in non-agricultural areas and the specifications of PER11463. As such, their effectiveness cannot be guaranteed.

Prior to using the herbicides listed under PER11463 you must read or have read to you and understand the conditions of the permit. To obtain a copy of this permit, contact your local government or visit www.apvma.gov.au. It is a requirement of the permit that all persons using products covered by this off-label permit comply with the details and conditions listed in the permit. Permit number PER11463 expires on 30 June 2014. While the permit may be extended, it is essential that landholders keep up-to-date by contacting your local government or by visiting the APVMA website.

[2] A DAFF permit is required for Moreton Bay and Sunshine Coast Regional shires because of environmental concern with picloram.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

This information sheet was developed with funding support from Meat and Livestock Australia.

Table 1: Herbicides[1] for controlling white-ball Acacia.

Method	Herbicide	Rate	Registration Status
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) e.g. Conquerer®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	Registered Australia wide for the control of wattle (*Acacia spp.*)
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) + 8 g/L aminopyralid) e.g. Grazon Extra®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	Registered Australia wide for the control of wattle (*Acacia spp.*)
Basal bark	triclopyr (240 g/L) + picloram (120 g/L) e.g. Access®	• 1 L/60 L diesel	Registered Australia wide for the control of Acacia species
Cut and paint	triclopyr (240 g/L) + picloram (120 g/L) e.g. Access®	• 1 L/60 L diesel	Registered for Acacia species
Cut stump	picloram (43 g/kg) e.g. Vigilant®	• Apply 3–5 mm thick over the cut surface (< 20 mm in diameter) • Apply 5 mm thick over the cut surface (> 20 mm in diameter) • In multi-stem plant treat at least 80% of stems	Registered for woody weeds

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

[1] There is no herbicide currently registered for control of white-ball Acacia in Queensland; however, an off-label use permit (Permit No. 11463) allows the use of various herbicides for the control of environmental weeds in non-agricultural areas, bushland, forests, wetlands, and coastal and adjacent areas.

Table 1 includes treatment options allowed by the permit. It is important to note that specific research on the use of herbicides to control white-ball Acacia has not been undertaken to date. Therefore, the treatment options outlined in Table 1 are suggestions only, based on registered controls for similar weeds in non-agricultural areas and the specifications of PER11463. As such, their effectiveness cannot be guaranteed.

Prior to using the herbicides listed under PER11463 you must read or have read to you and understand the conditions of the permit. To obtain a copy of this permit, contact your local government or visit www.apvma.gov.au. It is a requirement of the permit that all persons using products covered by this off-label permit comply with the details and conditions listed in the permit. Permit number PER11463 expires on 30 June 2014. While the permit may be extended, it is essential that landholders keep up-to-date by contacting your local government or by visiting the APVMA website.

[2] A DAFF permit is required for Moreton Bay and Sunshine Coast Regional shires because of environmental concern with picloram.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

This information sheet was developed with funding support from Meat and Livestock Australia.

The control methods referred to in this information sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DAFF does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

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Department of Agriculture, Fisheries and Forestry

pannicle jointvetch

Aeschynomene paniculata Willd. ex Vogel

Current situation

Pannicle jointvetch can form dense stands in native Australian grasslands and sown pastures in northern Australia and is well-adapted to a range of sandy, sandy-loam and duplex soils used for grazing in Queensland. Pannicle jointvetch is of low palatability compared to other native and introduced legumes and it can displace more palatable companion vegetation over time. Prolific production of long-lived, easily-dispersed seeds enables pannicle jointvetch to form scattered and dense patches in grasslands.

Pannicle jointvetch is native to tropical and seasonally dry areas of northern, central and southern America. Ecotypes were introduced and small (mostly < 1 ha) experimental plots established in north Queensland between the mid-1980s and mid-1990s to assess value for livestock production. It has proven particularly well-adapted to coastal and sub-coastal areas north of Mackay on a range of sandy and loam-textured soils. Pannicle jointvetch was rejected for further development because of low acceptability by livestock in Queensland. It was later nominated as a national 'Sleeper Weed' because of its perceived economic impact on the grazing industry.

A 15-year monitoring and control program conducted by the Queensland Government, with assistance from staff of CSIRO and JCU and co-funding from the Beef Industry, began in 1999 to minimise any impact pannicle jointvetch may have on pastures and grasslands. With the exception of one large population on Cape York Peninsula, pannicle jointvetch is limited to small, scattered populations in close proximity to the original plant evaluation sites in northern Queensland. Long-lived seed in soil means that plants are expected to emerge over the next 5–10 years depending on the levels of viable seeds in soil.

Great state. Great opportunity.

Description

Pannicle jointvetch is a perennial, erect, sub-shrub legume commonly 0.6–1.2 m high and to 0.6 m across, but can grow to 2.0 m high and to 1.5 m diameter under favourable conditions. Pannicle jointvetch has a high proportion of stem (few hairs) compared to leaf. The bipinnate leaves have no hairs on the upper surface and a few bristles on the lower, are a distinctive bluish colour or sometimes blue/green, and are commonly arranged in sets of up 20–40 leaflets (2–5 mm long and 1 mm wide). The leaves yellow and fall under dry conditions. The flowers are small (6 mm long), pea-like, bright yellow and are arranged along a series of stalks off a main stalk up to 40 cm long. The 15–25 mm pods comprise roughly-ovoid segments (3–4 mm long) that easily detach when mature (mid-dark brown). Each segment contains one small (2.5 mm long) yellow seed.

Pannicle jointvetch plants may be confused with other *Aeschynomene* species. American jointvetch (*A. americana*) is a useful legume that grows in the same environment. Key differences are that American jointvetch has green leaflets and hairy stems, mauve, creamy or pale yellow/orange flowers and has 'D' shaped pod segments with some bristles on the surface.

Reproduction and dispersal

Pannicle jointvetch plants can flower 3–4 months after establishment, and mature plants can flower whenever there is sufficient moisture and temperature (all year in some coastal north Queensland environments). Frost will stop growth, but often not kill plants.

Mature seed is produced within two months of flowering. The seed pods do not violently shatter and seeds fall close to the plant forming extensive seed banks. A large proportion (over 50%) of mature pannicle jointvetch seed has hardseed dormancy and some of this seed is expected to survive at least five years in soil.

Seeds are the principal form of dispersal. The small, easily-detached pod-segments can be dispersed by machinery, slowly move down-slope following heavy rainfall, or be moved by livestock or wildlife (on wet coats). Although the plant has low palatability, livestock will occasionally eat seed pods. A small proportion of seeds are known to survive the ruminant gut (study with sheep) and anecdotal evidence during the control program suggests there is some spread by livestock by this manner.

Declaration status

A Queensland Government Weed Risk Assessment was completed on pannicle jointvetch. Pannicle jointvetch is not declared under the *Land Protection (Pest and Stock Route Management) Act 2002*, but there may be control requirements imposed by local governments.

Management strategies

Control of pannicle jointvetch is simply based on locating all plants and killing new plants before they form mature seeds. The plants are usually found in open or dense grasslands or pastures, often under tree cover with light to moderate shade. It is generally recommended to look for plants 1–2 months after significant rainfall, particularly in summer months, with a follow-up search two months later. Detection is relatively easy once mature, but care is required to find seedlings, which may be covered by a grass canopy.

Small populations of scattered plants can be controlled by grubbing-out with a mattock or hand pulling (small plants), taking care to remove as much of the root systems as possible. Plants can also be killed by spot-spraying with selective knock-down herbicides (Table 1) (*see note on the use of herbicides below Table 1*).

Herbicides that preserve grass cover are recommended as this provides competition for emerging pannicle jointvetch seedlings. Knock-down herbicides are most effective when plants are vegetative and growing vigorously, and control is often poor when plants have formed mature seeds. The collection and destruction (fire) of any mature seeds is recommended.

Larger populations are best controlled through the use of selective herbicides. The use of fire (to stimulate germination and kill or set-back some plants) following by the use of herbicides may be effective for depleting numbers of viable seeds in soil. There does not appear to be any capacity for grazing to suppress flowering or kill established plants.

Once the infested area has been defined, it is important to restrict the opportunity for seed spread (if not fully prevented). This can be achieved by restricting machinery access and washing down equipment before moving from the site. Although grazing can aid detection of plants, it is recommended livestock not be allowed access to infested areas.

Table 1: Herbicides[1] for controlling pannicle jointvetch.

Method	Herbicide	Rate	Registration Status
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) e.g. Conquerer®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	PERMIT 11463 (Queensland)
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) + 8 g/L aminopyralid) e.g. Grazon Extra®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	PERMIT 11463 (Queensland)

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

[1] There is no herbicide currently registered for control of pannicle jointvetch in Queensland; however, an off-label use permit (Permit No. 11463) allows the use of various herbicides for the control of environmental weeds in non-agricultural areas, bushland, forests, wetlands, and coastal and adjacent areas.

Table 1 includes treatment options allowed by the permit. It is important to note that specific research on the use of herbicides to control pannicle jointvetch has not been undertaken to date. Therefore, the treatment options outlined in Table 1 are suggestions only, based on registered controls for similar weeds in non-agricultural areas and the specifications of PER11463. As such, their effectiveness cannot be guaranteed.

Prior to using the herbicides listed under PER11463 you must read or have read to you and understand the conditions of the permit. To obtain a copy of this permit, contact your local government or visit www.apvma.gov.au. It is a requirement of the permit that all persons using products covered by this off-label permit comply with the details and conditions listed in the permit. Permit number PER11463 expires on 30 June 2014. While the permit may be extended, it is essential that landholders keep up-to-date by contacting your local government or by visiting the APVMA website.

[2] A DAFF permit is required for Moreton Bay and Sunshine Coast Regional shires because of environmental concern with picloram.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

This information sheet was developed with funding support from Meat and Livestock Australia.

Department of Agriculture, Fisheries and Forestry

Brazilian jointvetch

Aeschynomene brasiliana (Poir.) DC

Current situation

Brazilian jointvetch can form dense stands in native Australian grasslands and sown pastures in northern Australia and is well-adapted to a range of sandy-textured soils used for grazing in Queensland. Brazilian jointvetch is of moderate palatability to livestock compared to other native and introduced legumes and is usually only eaten (often to the crowns) when companion grasses decline in feed quality as they mature and hay-off under dry conditions. Prolific production of long-lived, easily-dispersed seeds enables Brazilian jointvetch to form scattered and dense patches in grasslands and woodland.

Brazilian jointvetch is native to tropical and seasonally dry areas of northern, central and southern America, where it is commonly found in woodland and savannahs and used to enhance the productivity of poor quality grassland. Ecotypes were introduced and small (mostly < 1 ha) experimental plots established in north Queensland between the mid-1980s and mid-1990s to assess value for livestock production. It has proven particularly well-adapted to coastal and sub coastal areas north of Bowen on sandy soils.

Brazilian jointvetch was rejected for further development due to there being no demonstrated benefits over other legumes (*Stylosanthes scabra*) adapted to similar situations and because of difficult seed production due to sticky seeds.

A 15-year monitoring and control program conducted by the Queensland Government, with assistance from staff of CSIRO and JCU and co-funding from the Beef Industry, began in 1999 to minimise any impact Brazilian jointvetch may have on pastures and grasslands. With the exception of a few large populations in north Queensland, Brazilian jointvetch is limited to small, scattered populations in close proximity to the original plant evaluation sites in central and northern Queensland. Long-lived seed in soil means that plants are expected to emerge over the next 5–10 years depending on the levels of viable seeds in soil.

Great state. Great opportunity.

Description

Brazilian jointvetch is a perennial, prostrate or decumbent (sprawling) herbaceous legume commonly up to 0.5 m high and 0.6–1.2 m across, but can form a diameter of up to 6 m under favourable conditions without grazing. Brazilian jointvetch has a high proportion of stem (bristly and sticky) compared to leaf. The bright green pinnate leaves (2–3 cm long) have no hairs on the upper surface and a few bristles on the lower, and are commonly arranged in sets of up 22 elliptical to oblong leaflets (5–15 mm long and 3–8 mm wide). The leaves yellow and fall under dry conditions. The inflorescence comprises 1–8 pea-like, bright yellow flowers. The pods comprise 2–5 or sometimes more, roughly-ovoid segments (3–4 mm long and 2–3 mm wide) that easily detach when mature (mid-dark brown). Each segment contains one small (2.5 mm long) dark-brown seed.

Brazilian jointvetch plants may be confused with other *Aeschynomene* species. Jointvetch (*A. falcata*) is a useful legume that can grow in similar environments. Key differences are that Jointvetch has smaller hairs on the stem, is less sticky and has fewer leaflets grouped together (up to nine) than Brazilian jointvetch.

Reproduction and dispersal

Brazilian jointvetch plants can flower 3–4 months after establishment following summer rainfall and a short-day flowering response has been reported at sub-tropical (21°C) latitudes. Frost will stop growth and flowering, but often not kill plants.

Mature seed is produced within two months of flowering. The seed pods do not violently shatter and seeds fall close to the plant forming extensive seed banks. A significant proportion of mature Brazilian jointvetch seed has hardseed dormancy and some of this seed is expected to survive at least five years in soil.

Seeds are the principal form of dispersal. The small, easily-detached and sticky pod-segments can be dispersed by machinery, slowly move down-slope following heavy rainfall, or be moved by livestock or wildlife (on coats). Seed is also frequently eaten by livestock in seasonally dry environments and there is anecdotal evidence (plants emerging in dung and frequency of plants around cattle pads and camps) of a proportion of these seeds surviving the ruminant gut.

Declaration status

A Queensland Government Weed Risk Assessment was completed on Brazilian jointvetch. Brazilian jointvetch is not declared under the *Land Protection (Pest and Stock Route Management) Act 2002*, but there may be control requirements imposed by local governments.

Management strategies

Control of Brasilian jointvetch, where desired, is simply based on locating all plants and killing new plants before they form mature seeds. The plants are usually found in open or dense grasslands or pastures, often under tree cover with light to moderate shade. It is generally recommended to look for plants 1–2 months after significant rainfall, particularly in summer months, with a follow-up search two months later. Detection is relatively easy once mature but care is required to find seedlings, which may be covered by a grass canopy.

Small populations of scattered plants can be controlled by grubbing-out with a mattock or hand pulling (small plants). Plants can also be killed by spot-spraying with selective knock-down herbicides (Table 1) (*see note on the use of herbicides below Table 1*). Herbicides that preserve grass cover are recommended as this provides competition for emerging Brazilian jointvetch seedlings. Knock-down herbicides are most effective when plants are vegetative or (early) flowering and growing vigorously, and control is often poor when plants have formed mature seeds. The collection and destruction (fire) of any mature seeds is recommended.

Larger populations are best controlled through the use of selective herbicides. Grazing using heavy stocking rates can also be used to suppress flowering, particularly when companion vegetation is haying-off, although most plants will survive. The use of fire (to stimulate germination and kill or set-back some plants) followed by the use of herbicides may be effective for depleting numbers of viable seeds in soil.

Once the infested area has been defined, it is important to restrict the opportunity for seed spread (if not fully prevented). This can be achieved by restricting machinery access and washing down equipment before moving from the site. It is particularly important to control access by livestock, ensuring that there is sufficient time for seeds to pass through the gut before they leave the site (about five days).

Table 1: Herbicides[1] for controlling Brazilian jointvetch.

Method	Herbicide	Rate	Registration Status
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) e.g. Conquerer®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	PERMIT 11463 (Queensland)
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) + 8 g/L aminopyralid) e.g. Grazon Extra®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	PERMIT 11463 (Queensland)

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

[1] There is no herbicide currently registered for control of Brazilian jointvetch in Queensland; however, an off-label use permit (Permit No. 11463) allows the use of various herbicides for the control of environmental weeds in non-agricultural areas, bushland, forests, wetlands, and coastal and adjacent areas.

Table 1 includes treatment options allowed by the permit. It is important to note that specific research on the use of herbicides to control Brazilian jointvetch has not been undertaken to date. Therefore, the treatment options outlined in Table 1 are suggestions only, based on registered controls for similar weeds in non-agricultural areas and the specifications of PER11463. As such, their effectiveness cannot be guaranteed.

Prior to using the herbicides listed under PER11463 you must read or have read to you and understand the conditions of the permit. To obtain a copy of this permit, contact your local government or visit www.apvma.gov.au. It is a requirement of the permit that all persons using products covered by this off-label permit comply with the details and conditions listed in the permit. Permit number PER11463 expires on 30 June 2014. While the permit may be extended, it is essential that landholders keep up-to-date by contacting your local government or by visiting the APVMA website.

[2] A DAFF permit is required for Moreton Bay and Sunshine Coast Regional shires because of environmental concern with picloram.

Further information

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This information sheet was developed with funding support from Meat and Livestock Australia.

Department of Agriculture, Fisheries and Forestry

indigofera

Indigofera schimperi
Jaub. and Spach

Current situation

Indigofera can form dense stands in native Australian grasslands and sown pastures in northern Australia and is well-adapted to cracking clay and clay-loam soils used for cropping and grazing in Queensland. Although not considered to be toxic to livestock (unlike some *Indigofera*), indigofera is of low palatability compared to other native and introduced legumes and it can displace more palatable companion vegetation over time. Prolific production of long-lived seed enables indigofera to form dense, slow-moving patches in grasslands.

Indigofera is native to seasonally dry areas of Africa, where it is regarded as a warm season forage for livestock. Ecotypes were introduced and small (mostly < 1 ha) experimental plots established in Queensland between the mid-1970s and mid-1990s to assess value for livestock production. Indigofera was rejected for further development because of low acceptability by livestock in Queensland.

A 15-year monitoring and control program conducted by the Queensland Government, with assistance from staff of CSIRO and JCU and co-funding from the Beef Industry, began in 1999 to minimise any impact indigofera may have on pastures and grasslands. Indigofera is limited to small, scattered populations in close proximity to the original plant evaluation sites in southern and central (mostly) and northern (few) Queensland. Long-lived seed in soil means that plants are expected to emerge over the next 5–10 years depending on the levels of viable seeds in soil.

Description

Indigofera is a perennial, erect, sub-shrub legume usually 0.3–0.8 m high and to 0.8 m across, but can grow to 1.5 m high and to 3 m in diameter under favourable conditions. The pinnate leaves have fine hairs, are a bluish colour and are commonly arranged in sets of seven leaflets (alternate along the rachis), or sometimes five. The leaves dry in winter to have a sharp tip. The flowers are small, pea-like, mauve/purple, and are arranged along an erect stem up to 20 cm long. The mauve/purple pods are up to 30 mm long, 2 mm wide and covered in silky hairs. They can contain up to 12 seeds.

Great state. Great opportunity.

Indigofera plants may be confused with butterfly pea (*Clitoria ternatea*), a useful legume that grows on the same soils. Butterfly pea has five leaflets, usually larger and roundish and in various green tones, on softer stems. Butterfly pea flowers are arranged singly (occasionally in pairs), are much larger, and come in various shades of blue and sometimes white. It can also be mistaken for other *Indigofera* such as *I. hirsuta*, which is similar but has more obviously red stems than *I. schimperi*.

Reproduction and dispersal

Indigofera plants can flower a few months after establishment, and mature plants can flower throughout the spring and summer. Mature seed is produced within two months of flowering. The seed pods do not violently shatter and seeds fall close to the plant forming extensive seed banks. Indigofera seed has hardseed dormancy and some of this seed is known to survive at least 12 years in soil. However, most seed will germinate within four years in normal seasons. Drought conditions likely prolong seed longevity in soil.

Seeds are the principal form of dispersal, although plants can slowly spread vegetatively via root 'suckering'. The small seeds can be dispersed by machinery, slowly move down-slope following heavy rainfall, or be moved by livestock. Although possible, low palatability reduces the capacity for spread by livestock.

Declaration status

A Queensland Government Weed Risk Assessment was completed on indigofera. Indigofera is not declared under the *Land Protection (Pest and Stock Route Management) Act 2002*, but there may have control requirements imposed by local governments.

Management strategies

Control of indigofera is simply based on locating all plants and killing new plants before they form mature seeds. The plants are usually found in dense grasslands or pastures on fertile soils. It is generally recommended to look for plants 1–2 months after significant rainfall, particularly in summer months, with a follow-up search two months later. Try to visit each site twice a year. Detection is relatively easy once mature but care is required to find seedlings, which may be covered by a grass canopy. Each site should be monitored for 4–5 years after the last plants are seen.

Small populations of scattered plants can be controlled by grubbing-out with a mattock or hand pulling (small plants), taking care to remove as much of the root systems as possible (plants may regrow from root fragments). Plants can also be killed by spot-spraying with selective knock-down herbicides (Table 1) (*see note on the use of herbicides below Table 1*). Herbicides that preserve grass cover are recommended as this provides competition for emerging indigofera seedlings. Knock-down herbicides are most effective when plants are growing vigorously and vegetative. Repeat applications may be required for older plants. The collection and destruction (fire) of any mature seeds is recommended.

Larger populations can be controlled through the use of selective herbicides applied by alternative means (spray boom). Where possible cultivation and the growing of a cereal crop (oats, wheat, maize, sorghum), wherein herbicides are applied to control legume weeds, works well. The use of fire (to stimulate germination) followed by cultivation or the use of herbicides may be effective for depleting numbers of viable seeds in soil. There does not appear to be any capacity for grazing to suppress flowering or kill established plants.

Once the infested area has been defined, it is important to restrict the opportunity for seed spread (if not fully prevented). This can be achieved by restricting machinery access and washing down equipment before moving from the site. Although grazing can aid detection of plants, it is recommended livestock not be allowed access to infested areas.

Table 1: Herbicides[1] for controlling indigofera.

Method	Herbicide	Rate	Registration Status
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) e.g. Conquerer®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	PERMIT 11463 (Queensland)
Foliar spray[2]	triclopyr (300 g/L) + picloram (120 g/L) + 8 g/L aminopyralid) e.g. Grazon Extra®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	PERMIT 11463 (Queensland)
Foliar spray	fluroxypyr (333 g/L) e.g. Starane-Advance® + metsulfuron-methyl (600 g/kg) e.g. Brushoff®	• 200–350 mL/100 L water + 100% non-ionic surfactant at 100 mL/100 L water, with higher rates for flowering plants	PERMIT 11463 (Queensland)

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

[1] There is no herbicide currently registered for control of indigofera in Queensland; however, an off-label use permit (Permit No. 11463) allows the use of various herbicides for the control of environmental weeds in non-agricultural areas, bushland, forests, wetlands, and coastal and adjacent areas.

Table 1 includes treatment options allowed by the permit. It is important to note that specific research on the use of herbicides to control indigofera has not been undertaken to date. Therefore, the treatment options outlined in Table 1 are suggestions only, based on registered controls for similar weeds in non-agricultural areas and the specifications of PER11463. As such, their effectiveness cannot be guaranteed.

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[2] A DAFF permit is required for Moreton Bay and Sunshine Coast Regional shires because of environmental concern with picloram.

Further information

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This information sheet was developed with funding support from Meat and Livestock Australia.

9.22Project officer opinions of plant population status and landowner collaboration, August 2014.

Key: Population 0 = none, 1=10, 2=10-200 etc.; methods h = herbicide, f = fire, c = cultivation, m = manual removal; Future effort U = unlikely, S = yes with support, I = yes independently, N = not considered worth controlling.

Location	Latitude	Longitude	Species	Site visits (Y/N)			Population			Best control method	Landowner awareness			Landowner effort		Future effort?
				2011/12	2012/13	2013/14	Area (ha)	Population	Type		ID	Spread	Method	Method	% done	(U,S,I,N)
Batavia Downs RS	12.66	142.66	*A. brasiliana*	y	y	y	3	4	s	no control	y	y	n	NA	NA	NA
			A. paniculata	y	y	y	5	5	s,f	h, fire	y	y	y	h,fire	80	S
Wrotham Park	16.71	144.07	*I. schimperi*	y	y	y	2	1	o	h,g	n	y	y	n	0	S
Southedge RS	16.98	145.34	*A. paniculata*	y	y	y	3	3	s	h	n	n	n	n	0	?
			A. angustissima	y	y	y	2	0	o	h,g	n	n	n	n	0	?
Walkamin RS	17.13	145.42	*A. angustissima*	y	y	y	2	1	i	h,m	y	y	y	h,m	100	S
			A. brasiliana	y	y	y	1	1	i	h	y	y	y	h	100	S
			A. paniculata	y	y	y	3	3	s	h	y	y	y	h	100	S
Springmount	17.24	145.3	*A. brasiliana*	n	n	y	sus. 3	sus. 3	sus. F	no control	n	n	n	n	0	sus. N
Burlington	17.82	144.36	*A. brasiliana*	y	y	y	5	sus. 3,4	s	no control	n	n	n	n	0	sus. N
Sugarbag	17.94	144.99	*A. brasiliana*	y	y	y	4	4	s,f	no control	y	y	y	n	0	N
Lamonds Lagoon	18.37	145.14	*A. brasiliana*	y	y	y	3	0	n1	no control	y	y	y	NA	NA	N
Helen's Hill	18.78	146.13	*A. angustissima*	y	y	y	1	0	n5	h	y	y	y	h	100	I
Campus Creek	19.32	146.75	*A. angustissima*	y	y	y	2	1	i	h	y	y	y	h	100	I
Lansdown (CSIRO)	19.66	146.83	*A. angustissima*	y	y	y	2	1	i	h	y	y	y	h	100	I
Lansdown (Lennards)	19.65	146.81	*A. angustissima*	y	y	y	3	5	s	m,h	y	y	y	y	50	S
Bluff Downs	19.67	145.5	*I. schimperi*			no access	1	sus 1	i	h	n	n	n	n	0	U
Hillgrove	19.68	145.76	*A. angustissima*			y	1	0	n	NA	NA	NA	NA	NA	NA	NA
Swans Lagoon	20.08	147.17	*A. paniculata*	y	y	y	1	1	i	h	n	n	n	n	0	?
			A. brasiliana	y	y	y	3	4	f	no control	n	n	n	n	0	?
Mt Dangar	20.2	148.67	*A. brasiliana*		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
			A. paniculata		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
Yallatup (remove)	20.3	148.5	*A. paniculata*				sus. 1	sus. 0	sus. N5	NA	NA	NA	NA	NA	NA	suspected clean
Goorganga	20.45	148.45	*A. brasiliana*			y	1	0	n1	NA	NA	NA	NA	NA	NA	
			A. paniculata			y	1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Braceborough	20.48	145.82	*A. brasiliana*			y	?	4?	s	no control	y	y	y	n	0	S
Birralee	20.65	147.68	*A. angustissima*	y		y	1	0	n1	NA	NA	NA	NA	NA	NA	suspected clean
			A. brasiliana	y		y	1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
			A. paniculata	y		y	1	0	n5	NA	NA	NA	NA	NA		suspected clean
Myuna	20.67	147.67	*I. schimperi*	y		y	1	1	o	g,h	?	Y	T	N	0	U (leasing back)
Havilah	20.88	147.86	*I. schimperi*	y		y	1	0	n	NA	NA	NA	NA	NA	NA	NA
Toorak RS	21.03	141.78	*A. angustissima*		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
			I. schimperi		y		1	0	n5	NA	NA	NA	NA	NA	NA	NA
Crediton	21.18	148.5	*A. brasiliana*		y		2	0	n	NA	NA	NA	NA	NA	NA	NA
Tedlands	21.36	149.18	*A. brasiliana*	y	y	y	4	3	s	no control	y	y	y	n	0	sus. N or S
			A. paniculata	y	y	y	4	4	s, f		y	y	y	n	0	sus. S
Glensfield	21.47	147.97	*A. brasiliana*	y	y	y	1	0	n1	no control	NA	NA	NA	NA	NA	NA
			A. paniculata	y	y	y	1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Strathdale	21.53	149	*A. paniculata*	y	y	y	3	2	s	h	y	y	y	n	0	sus. N or S
			A. brasiliana	y	y	y	3	3	s	no control	y	y	y	n	0	sus. S
Lynford	21.75	148.67	*A. brasiliana*	y	y	y	3	1	o	h	y	y	y	n	0	sus. N
			A. paniculata	y	y	y	1	0	n5	NA	NA	NA	NA	NA	NA	NA
Oxford Downs	21.82	148.67	*I. schimperi*	y	y	y	2	2	s	h,g	y	y	y	n	0	?
Carmilla Glen	21.96	149.5	*A. brasiliana*			y	2	sus. 0		no control	?	?	?	n	0	needed?
Willunga	22.2	148.37	*I. schimperi*			y	1	1	i	h	n	n	n	n	0	?
Eungy	22.36	148.87	*A. brasiliana*		y		1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
			A. paniculata		y		1	0	n5	NA	NA	NA	NA	NA	NA	suspected clean

Location	Latitude	Longitude	Species	Site visits (Y/N)			Population			Best control method	Landowner awareness			Landowner effort		Future effort?
				2011/12	2012/13	2013/14	Area (ha)	Population	Type		ID	Spread	Method	Method	% done	(U,S,I,N)
Carramah	22.87	147.9	*I. schimperi*	y	y	y	1	0	n	NA	NA	NA	c	NA	NA	NA
Rosebank	23.54	144.26	*A. angustissima*	y	y	y	1	0	n	NA	NA	NA	c	NA	NA	NA
Granite Vale	22.42	149.53	*A. brasiliana*	y	y	y	2	2	o	no control	y	y	y	NA	NA	NA
			A. paniculata	y	y	y	2	1	o	h	y	y	y	n	0	sus. S
Mutation	22.48	147.48	*I. schimperi*	y	y	y	2	2	s	h	worker?	?	h (crop)	h (crop)	10	U
Etna Ck	23.23	150.3	*A. angustissima*	y	y	y	1	1	i	h	n	n	n	n	0	U (prison)
Parkhurst	23.32	150.52	*A. angustissima*	y	y	y	2	2	f	h	y	y	y	30	h	s
Emerald RS	23.46	148.01	*I. schimperi*	y	y	y	2		s	h	?	?	not yet	n	0	need manager push
Sorrell Hills	23.57	149.68	*A. brasiliana*	y		owner chat	2	3	f	h	?	y	y	n	0	S
			I. schimperi	y		owner chat	2	1	o	h	?	y	y	n	0	S
Raglan	23.75	150.75	*A. angustissima*	y	y	y	2	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Goondooroo	23.82	148.12	*I. schimperi*	y		owner chat	2	3	f	h	y	y	y	n	0	S
Galloway Plains	24.1	150.57	*A. brasiliana*	y	y	y	2	0	n5	no control	NA	NA	NA	NA	NA	suspected clean
			I. schimperi	y	y	y	2	0	n5	NA	NA	NA	NA	NA	NA	suspected clean
Birrong	24.23	148.3	*I. schimperi*	y	y	owner chat	5	2	i	h	y	y	h	h	20	s
Wadeleigh	24.28	151.53	*A. brasiliana*	y	y	y	2	0	n1	no control	n	y	y	NA	NA	suspected clean
Kapalee	24.4	150.42	*I. schimperi*	y	y	y	2	2	s,i	h	y	y	h	n	0	n,s
Rangeview	24.7	150.1	*I. schimperi*	y	y	y	2	1	i	c,h	?	?	c	c	50	S
Brigalow RS	24.82	149.77	*I. schimperi*	y	y	sold	2	2	s	h	?	?	?	n	0	?
Brian Pastures RS	25.4	151.4	*A. angustissima*	y	y	local	2	1	i	h	y	y	y	h	50	S
			A. brasiliana	?	?	?	to check			no control	sus. N	sus. N	sus. N	NA	NA	sus. s
			I. schimperi	y	y	local	3	3	s	c,h	y	y	c,h	c,h	80	S
Kiamanna	25.42	148.85	*I. schimperi*	y	y	y	1	1	n1	h	?	y	y	n	0	S
Brumich	25.68	146.2	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Narayen RS	25.68	150.88	*A. brasiliana*	y	y	y	2	0	n1	no control	n	n	n	NA	NA	suspected clean
			I. schimperi	y	y	y	3	4	s	h	y	y	y	h	30	S
Glen Eden	25.77	146.22	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Valera Vale	25.88	146.27	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Kookaburra	25.92	149.78	*I. schimperi*	y	y	y	2	2	s	h	y	y	y	h	80	I
Belcrest (Wandoan)	26	149.9	*I. schimperi*	y	y	y	2	1	o	g,h	y	y	y	n	0	sus. N
Rolfe Park	26.38	148.77	*I. schimperi*	y			1	0	n5	NA	y	y	y	NA	NA	suspected clean
Norton	26.39	148.76	*I. schimperi*		y	y	1	1	i	g	n	n	n	n	0	?
Charleville laboratory	26.41	146.24	*A. angustissima*				sus. 2	sus. 0		g	sus. N	sus. N	sus. N	NA	NA	suspected clean
Holyrood	26.49	148.45	*I. schimperi*	y	y	y	1	1	i	g,h	y	y	y	n	0	S
Bindaroo (Roma)	26.67	149.03	*I. schimperi*	y			1	0	n5	c	y	y	y	c	100	suspected clean
Sunset Downs (Tara)	27.28	150.25	*I. schimperi*	y	y	y	1	1	o,n1	h	y	y	y	n	0	almost clean
Ellenvale	26.73	150.72	*I. schimperi*	y	y	y	1	1	i	g,h	?	y (marke	g	n	100	? New owners
Lyndon Caves	26.83	148.94	*A. angustissima*		y	y	1	0	n1	g	NA	NA	NA	NA	NA	S
Warrill View	27.5	152.4	*A. angustissima*	y	y	y	1	2	f	g,h	n	y	y	n	0	?
Glenbower (Pittsworth)	27.84	151.58	*I. schimperi*	y	y	y	1	1	n1	c,h	y	y	y	n	0	S
Ula Ula	28.02	149.42	*I. schimperi*		y		1	0	n5	g	NA	NA	NA	NA	NA	S
Bringalily	28.09	151.17	*I. schimperi*		y		1	0	n5	g	NA	NA	NA	NA	NA	S
Kindon	28.09	150.78	*I. schimperi*	y	y	y	1	1	n1	g,h	y	y	y	n	0	S
Boongargil (Toobeah)	28.53	149.67	*I. schimperi*	y	y	y	1	0	n1	c,h	y	y	y	n	0	S,I
Valencia			*I. schimperi*	y	y	y	1	1	i	g/h	y	y	y	n	0	S

9.22 9.23Producer survey completed in October 2014 for selected properties known to contain target plants.

Site: _____ **Interviewee:** _____ **Date:** _____

Legume: _____ **Interviewer:** _____

Q1A: Do you know (common name) and could you identify it in a paddock?	**yes**	**no**	**unsure**

If no or unsure:

Q1B: Is it easily confused with any other pasture plants? [if so name them]	**yes**	**no**	**unsure**

Q1C: Would an identification aid, such as photos, be useful or would you prefer expert opinion?	**yes**	**no**

The following questions are about your opinions of the impact of the plant.

Q2A: Has _____ (common name) had any significant impact on your operations, positive or negative?	**yes**	**no**	**unsure**

Q2B: Do you think _____ (common name) could become a significant problem to your operations if not controlled?	**yes**	**no**	**unsure**

Q2C: What are the major weeds on your property or in your locality? [list top 3]	**1** **2** **3**

Q2D: How does _____ (common name) compare to some of these weeds?	

The next questions are about future control.

Q3A: Do you think control should be continued? Why?	**yes**	**no**	**unsure**

If Yes to 3A:

Q3A: What do you think is the best form of control for your situation?

Q3B: Would you be willing to undertake control on your property?

yes	no

Q3C: Would you allow project staff to access you property (with prior approval) to complete activities targeting control of _____ (common name)?

yes	no

Q3D: What is your preferred scenario for control if needed? (choose from one of the below options):

A: Undertake control by yourself with no or minimal input from project staff

B: Undertake control by yourself with limited input from project staff (information sheets and occasional visits to assist with identification)

C: Undertake control with regular visits (say twice a year) by project staff to assist with identification, monitoring and weed control strategies

D: Undertake control by yourself with assistance in terms of supply of herbicides (where appropriate) sufficient to complete weed control

E: Have control undertaken by project staff, recognising that visits may not always be frequent enough for optimum control.

Response

If answering B to D:

Q3E: How long would you require project staff to assist control on your property?

A: 1-2 years

B: 3-4 years

C: 5-6 years

D: Until plants are no longer detected.

Response

Q4: do you have any final questions or comments?

9.24Summary sections from Queensland Government Weed Risk Assessments completed during 2009 and 2010.

Acaciella angustissima

Acaciella angustissima (white ball acacia) is a highly variable perennial shrub native to subtropical and tropical America. Three varieties of this species are recognised (i.e. var. *angustissima*, var. *filicioides* and var. *texensis*), all of which were planted at various trial sites in Queensland in the 1970s and 1980s to investigate their potential as forage legumes. However, these trials concluded that *A. angustissima* was of limited value as cattle feed and that its weed potential probably outweighed any potential benefits.

Currently, *A. angustissima* exists as isolated naturalised specimens scattered at a handful of sites in Queensland, generally in close proximity to experimental plots where it has been planted. All sites are currently subject to an eradication program funded by the Queensland Primary Industries and Fisheries and the Meat and Livestock Association. A long-term commitment is required to detect isolated specimens and to exhaust long-lived seed banks in the soil.

This study was unable to find clear evidence that *A. angustissima* was a *major* weed elsewhere in the world. However, there is little doubt that it has weed risk, since it is documented to form thickets along roadsides and within rangelands within its native range and elsewhere. Ecologically, it has a number of attributes that confer weed risk: a history of successful naturalisation outside its native range, high fecundity, long-lived (hard coated) seeds and a propensity to quickly colonise gaps within open woodland and dry scrub.

Climatically, *A. angustissima* appears well adapted to Queensland's seasonally dry tropics as well as parts of the subtropics, primarily in coastal areas where rainfall is 800–3000 mm per annum, but with one variety (var. *texensis*) extending into much drier areas. If the very small numbers of specimens that currently exist in Queensland are allowed to spread, this species has clear potential to become a widespread and abundant pest over substantial areas of rangeland and deciduous vine scrubs in the dry tropics extending south into subtropical areas.

Aeschynomene paniculata

Aeschynomene paniculata (pannicle jointvetch) is a perennial legume native to tropical America. It was first planted in Queensland in the 1980s and 1990s, at *c*. 17 sites, to evaluate its potential use as a pasture legume. However, these trials concluded that it was of little value as cattle feed.

A. paniculata is currently invading grassy understoreys within open tropical woodlands, near where it was planted in North Queensland. At some sites, it is showing clear propensity to dominate both disturbed and relatively natural sites. Analysis of available literature on this species' native range, including information on its preferred climate and habitat types, supports a conclusion that is well adapted to the open *Eucalyptus* woodland within the seasonally dry tropics of North Queensland.

This study was unable to find evidence that *A. paniculata* was a major weed anywhere else in the world. However, it has naturalised in Hawaii and three congeners, *A. indica*, *A. virginica* and *A. rudis* are noxious in some US states.

Currently, *A. paniculata* exists as small, isolated populations along the east coast of Queensland, with the largest population at Batavia Downs in Cape York. All sites are currently the target of an ongoing eradication program funded by the Queensland Department of Primary Industries and Fisheries, co-sponsored by the Meat and Livestock Association (MLA) and the Australian Government's 'Defeating the Weeds Menace' program. To date, more than $0.5 million has been spent on eradication, with remaining populations of the plant proving resilient.

If control proves unsuccessful, *A. paniculata* has the potential to become widespread and abundant over substantial areas of North Queenland's tropical open eucalypt woodlands, possibly replacing more valuable pasture species and replacing native understorey plants.

Aeschynomene brasiliana

Aeschynomene brasiliana (Brazilian jointvetch) is a perennial legume native to tropical America. It was imported and planted in Queensland in the 1980s and 1990s to investigate its potential use as a new pasture legume. However, forage trials concluded that it was of little value as cattle feed.

A. brasiliana is currently invading grassy understoreys in open tropical woodlands near where it was planted at various sites in north Queensland. While there is little doubt that it is an invasive species, its impact appears relatively minor since it does not appear to dominate. Nevertheless, it is still regarded as an undesirable plant that could be competing with native plants and other more desirable pasture plants at low levels.

This study was unable to find evidence that *A. brasiliana* was a major weed anywhere else in the world. However, three congeners (*A. indica*, *A. virginica* and *A. rudis*) are noxious in some states of the United States and a fourth (*A. paniculata*) is considered to be a significant emerging weed in north Queensland.

Currently, *A. brasiliana* exists as very small populations scattered along the east coast of Queensland. Some sites have been subject to control efforts by the Department of Employment, Economic Development and Innovation (DEEDI), co-sponsored by the Meat and Livestock Association.

Climatically, *A. brasiliana* appears well adapted to the seasonally dry tropics of north Queensland. Within this climate zone, it is perhaps best adapted to open, tropical woodland. If allowed to spread, *A. brasiliana* has the potential to become a widespread plant over much of north Queensland's open tropical woodlands.

***Indigofera schimperi* (draft)**

Indigofera schimperi is a small perennial legume native to eastern and southern Africa. It was first planted in Queensland in the mid-1970s (until the mid-1990s) at a number of sites to evaluate its potential use as a pasture legume. However, these trials concluded that it was of little value as cattle feed.

While the pest potential of this species is considered to be low, it is currently being targeted for eradication, as a precaution, together with three other rejected pasture plants (*Aeschynomene paniculata*, *A. brasiliana* and *Acacia angustissima*). Funding for this eradication work is being provided by the QDPI&F and the MLA (with assistance from CSIRO).

Currently, *I. schimperi* exists only as a few scattered plants and seedlings in close proximity to pasture evaluation trial sites in Queensland. If not eradicated, it could spread over a substantial area of Queensland, primarily on open grasslands on neutral and alkaline clay soils in dry and seasonally dry tropical and subtropical areas where. annual rainfall is between 250 and 1,100 mm (semi-arid and sub-humid areas).

This study was unable to find any evidence that *I. schimperi* is a major weed anywhere else in the world. However, this species is listed as a minor weed of arable fields in eastern Ethiopia. Field observation in Queensland suggests that it could become a low-impact but persistent weed.

9.23 Summarised reports of project officer visits during B.NBP.0706, completed to August 2014.

Acaciella angustissima

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
21.12.11	Etna Creek	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.01	1	0	0	0	Treated plant was flowering. Very overgrown site.	*M. maximus, Desmathus*	Follow-up check June-December
		2. Treatment of plants	Cut stump and Grazon-DS@1L/100L equivalent applied to run-off.	0.5 L		100									
		3. Discussion with manager	None present (Regional Council)												
		4. Demonstration of practices	No												
21.12.11	Parkhurst	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		5	80	20	0.5	~50	2	~20	50	Most plants flowering and containing green pods. Approximately 30% contained mature pods. Site becoming weedy.	*M. maximus, C. gayanus, Leucaena, Desmanthus, Lantana*	Return April-June for follow-up treatment and demonstration
		2. Treatment of plants	Cut stump and Grazon-DS@1L/100L equivalent applied to run-off. Large	5 L											
		3. Discussion with manager	Karon Sturges (Sen. Admn.)												
		4. Demonstration of practices	Local staff willing to assist												
29.01.11	Walkamin	1. Inspection of site	Foot survey		1	100		1	10		5+5	0	Flowering and setting green pods	*Stylosanthes, H. contortus, T. triandra*	Followup checks for missed plants
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus Grazon applied by	2 L		100									
		3. Discussion with manager	Project officers on site												
		4. Demonstration of practices	NA												
17.05.12	Walkamin	1. Inspection of site	Foot survey		2	100		1	2 + 9	0	1	40	Most seed was immature. The regrowing plant had been treated with Grazon over a number of years and regrown from the base. Method of pulling plants highly effective at removing roots.	*Stylosanthes, H. contortus, T. triandra*	Return October-February
		2. Treatment of plants	Pulled with tractor. Seeds removed before pulling.	NA		50	50								
		3. Discussion with manager	Project officers on site												
		4. Demonstration of practices	NA												
22.05.12	Southedge RS	1. Inspection of site			2			0.01	3			0	Excellent control	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Check site in six months time.
		2. Treatment of plants	Plants pulled out with a tractor	NA			100								
		3. Discussion with manager	Yes.												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
30.01.13	Parkhurst	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		4	80	20	0.5	30	0	10	20	population reducing. Approximately 20% contained mature pods. Site becoming weedy.	*M. maximus, C. gayanus, Leucaena, Desmanthus, Lantana*	Follow-up check June-December
		2. Treatment of plants	Cut stump and Grazon-DS@1L/100L equivalent applied to run-off. Large	5 L											
		3. Discussion with manager	Karon Sturges (Sen. Admn.)												
		4. Demonstration of practices	Local staff willing to assist weed control. David Richter (Farmstaff)												
30.01.13	Etna Creek	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.01	0	0	0	0	No plants	*M. maximus, Desmathus*	Follow-up check June-December
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	None present (Regional Council)												
		4. Demonstration of practices	No												
13.03.13	Lansdown 1 (CSIRO)	1. Inspection of site	Foot survey		1	10	90	0.1	1 plant	0	0	0	Excellent local control since last visit.		Return when visting Lansdaown Wellards site.
		2. Treatment of plants	Yes.	Cut stump method, Grazon-DS											
		3. Discussion with manager	Yes. Will continue control												
		4. Demonstration of practices	NA												
13.03.13	Lansdown 2 (Wellards)	1. Inspection of site	NA		0.5	5	95	2	see prev. notes				Excellent job. All plants killed and site levelled and clean.		Return to treat any re-growing plants.
		2. Treatment of plants	Clearing by contractor plus stick-raking and levelling by Wellards												
		3. Discussion with manager	Multiple discussions between DAFF and contractor/Wellards/RC												
		4. Demonstration of practices	No												
13.03.13	Lansdown 2 (Wellards)	1. Inspection of site	Foot survey in site and surrounds		7	100	0	2	1000s emerging seedlings.	102 + 44	191	0 (green pods only)	Older plants found outside of fenced area (eastern and southern sides), along creek. Regrowing plants inside old area. Seedlings inside the crop not treated this visit.	*Urochloa* recolonising the cleared area very rapidly.	Return within 2 months to treat seedlings emerging after cultivation.
		2. Treatment of plants	Cut stump, Grazon-DS + glyphosatefor older plants, spray re-shooters.												
		3. Discussion with manager	No. Emailed after visit.												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
30.01.13	Parkhurst	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		4	80	20	0.5	30	0	10	20	population reducing. Approximately 20% contained mature pods. Site becoming weedy.	*M. maximus, C. gayanus, Leucaena, Desmanthus, Lantana*	Follow-up check June-December
		2. Treatment of plants	Cut stump and Grazon-DS@1L/100L equivalent applied to run-off. Large	5 L											
		3. Discussion with manager	Karon Sturges (Sen. Admn.)												
		4. Demonstration of practices	Local staff willing to assist weed control. David Richter (Farmstaff)												
30.01.13	Etna Creek	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.01	0	0	0	0	No plants	*M. maximus, Desmathus*	Follow-up check June-December
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	None present (Regional Council)												
		4. Demonstration of practices	No												
13.03.13	Lansdown 1 (CSIRO)	1. Inspection of site	Foot survey		1	10	90	0.1	1 plant	0	0	0	Excellent local control since last visit.		Return when visting Lansdaown Wellards site.
		2. Treatment of plants	Yes.	Cut stump method, Grazon-DS											
		3. Discussion with manager	Yes. Will continue control												
		4. Demonstration of practices	NA												
13.03.13	Lansdown 2 (Wellards)	1. Inspection of site	NA		0.5	5	95	2	see prev. notes				Excellent job. All plants killed and site levelled and clean.		Return to treat any re-growing plants.
		2. Treatment of plants	Clearing by contractor plus stick-raking and levelling by Wellards												
		3. Discussion with manager	Multiple discussions between DAFF and contractor/Wellards/RC												
		4. Demonstration of practices	No												
13.03.13	Lansdown 2 (Wellards)	1. Inspection of site	Foot survey in site and surrounds		7	100	0	2	1000s emerging seedlings.	102 + 44	191	0 (green pods only)	Older plants found outside of fenced area (eastern and southern sides), along creek. Regrowing plants inside old area. Seedlings inside the crop not treated this visit.	*Urochloa* recolonising the cleared area very rapidly.	Return within 2 months to treat seedlings emerging after cultivation.
		2. Treatment of plants	Cut stump, Grazon-DS + glyphosatefor older plants, spray re-shooters.												
		3. Discussion with manager	No. Emailed after visit.												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
23.05.13	Lansdown 2 (Wellards)	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Quad-bike survey in surrounds Cut stump, Grazon-DS for older plants, spray re-shooters and seedlings No. Emailed after visit. No		8	100	0	2	1000s emerging seedlings.	~50 inside + 20 outside	~20	~1	Older plants found outside of fenced area (eastern and southern sides), along creek. Regrowing plants inside old area. Many seedlings inside .	*Urochloa* recolonising the cleared area very rapidly. Weeds dense and obstructing control of seedlings.	Return within 2 months to treat remaining seedlings emerging after cultivation.
5-6.07.13	Lansdown 2 (Wellards)	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Quad-bike survey in surrounds Quad-spray Grazon-DS re-shooters and seedlings No. Emailed after visit. No	100 L	8	100	0	2	1000s emerging seedlings.	10	0	0	Last control excellent. Older plants found outside of fenced area dead. Excellent control of seedlings. Very dry but AA still green for spraying.	*Urochloa* recolonising the cleared area very rapidly. Weeds dense and obstructing control of seedlings.	Return after storm rainfall.
08.08.13	Walkamin	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Cut-stump and spray Grazon-DS@1L/100L equivalent plus wetter and dye No No	2 L	0.5	100 100		1	4	0	1	20 collected	Flowering and setting green pods	*Stylosanthes, H. contortus, T. triandra*	Followup checks for missed plants
28.08.13	Birralee	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA	NA	2	100		0.1	1?	0	0	0	Very dry. Leucaena grazed. Uncertain ID of AA. Deer!	*C. ciliari,s Leucaena, Desmanthus* (grazed)	Return by end of project.
25.11.13	Lansdown 1 (CSIRO)	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Yes. Yes. Will continue control NA	Cut stump method, Grazon-DS	1	10	90	0.1	a few plants	0	0	0	Chris requested follow-up control. CSIRO manager agreed		Check occasionally

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
25.11.13	Lansdown 2 (Wellards)	1. Inspection of site	Foot survey		1	50	50	2	100s	0	0	0	A few flowering plants, but none seeding.	Grasses becoming dominant - need control. Agreed to graze area.	Return to spray in next few months
		2. Treatment of plants	None												
		3. Discussion with manager	Yes. Agreed to graze site to reduce grass cover												
		4. Demonstration of practices	No												
23.12.14	Parkhurst	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		4	80	20	0.5	300	0	50	<1	Good control previous visit, but some regrowth. One plant contained a few mature seeds, others vegetative. Most (250) plants found close to core area.	*M. maximus, C. gayanus, Leucaena, Desmanthus, Lantana*	Follow-up check June-December
		2. Treatment of plants	Handspray seedlings and regrowing plants using Grazon DS+ wetter at label rates	8 L											
		3. Discussion with manager	Discussed with John Reeves, BQ												
		4. Demonstration of practices	John Reeves willing to supervise future control with local garden staff												
23.12.14	Etna Creek	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.01	1 (seedlings)	0	0	0	A recent fire appears to have stimulated germination of seeds under original plant.	*M. maximus, Desmathus*	Follow-up check June-December
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	None present (Regional Council)												
		4. Demonstration of practices	No												
22.01.14	Raglan	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.02	0	0	0	0	Site appears to be clean. No need to check furtrher.	*M. maximus, Desmathus*	Completed
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	None present (Regional Council)												
		4. Demonstration of practices	No												
~10.06.14	Walkamin	1. Inspection of site	Foot survey		0.5	100		1	2	0	0	0	Population reducing	*Stylosanthes, H. contortus, T. triandra*	Return one month after significant rainfall (storms).
		2. Treatment of plants	Cut-stump and spray Grazon-DS@1L/100L equivalent plus wetter and dye	1 L		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
15.05.14	Lansdown 1 (CSIRO)	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Yes. Local. Yes. Will continue control NA	Grazon-DS applied by helicopter when controlling sicklepod.	2	10	90	0.1	0	0	0	0	Excellent control. Site under effective local control.		Future checks for establishment and control of any new plants.
15.05.14	Lansdown 2 (Wellards)	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Grazon-DS + wetter and marker at label rates by quad. Yes. Visit details only. No	600 L	12	20	80	2	5000 seedlings	500	?100	5 older plants	A few plants missed last time - seeding. Bigger plants in area outside fenced area.	Grass dominant.	Return to spray plants under grass cover as they emerge.
10.09.14	Lansdown 2 (Wellards)	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Grazon-DS + wetter and marker at label rates by quad. Yes. Visit details only. No	200 L	1			2	frequent	frequent				Grasses becoming dominant - need control. Agreed to graze area.	Future checks for establishment and control of any new plants.
28.7.11	Warrill View	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Basal bark spray with Garlon and diesel and cut to 20 cm Spoke with tenant in the house. No	<10L	2	100 100		0.5	22		Many	0	Site grazed. AA plants grazed and evidence of frosting on leaf tips	Vigorous growth following wet summer	Revisit in 6 months (next summer).
25.10.12	Warrill View	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Access and diesel on whole plants (young) of cut stump. Graslan. Spoke with tenant in the house. No	<10L	2	100 100		0.5	12		13	0	Some grazing of young AA plants. New plants to 80 cm tall. Previous applications of Graslan effective at killing large plants. Nearby paddock (Lugg's) had no AA plants .	Vigorous grass growth following wet summer	Revisit after summer.

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
12.03.14	Lyndon Caves	1. Inspection of site	Foot survey		1	100		0.02	0	0	0	0	Very dry	Not specified	Consider clean
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	Not required												
3.06.14	Birralee	1. Inspection of site	Foot survey		2	100		0.1	0	0	0	0	Very dry. A few leucaena present.	*C. ciliari,s Leucaena, Desmanthus* (grazed)	Possibly clean. Occasional future checks for new plants.
		2. Treatment of plants	Not required	NA											
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	Not required												
14.05.14	Warrill View	1. Inspection of site	Foot survey		2	100		0.5	10	32	0	0	No seeding since the onset of treatments. Note: also checked nearby 'Lugg's paddock'. No plants found.	Droughted.	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Dug out (little leaf present). Graslan pellets scattered around holes.	<10L		100									
		3. Discussion with manager	Yes (phone)												
		4. Demonstration of practices	No												
09.05.11	Lansdown 2 (Wellards)	1. Inspection of site	Foot survey and photos		2	100		2	0	~500	0	Most	Owned by Wellards. Large flowering and seeding patch. Contained population. Previously bulldozed. Suspect Graslan provided was not applied.	*H. contortus, P.maximum, L.leucocephala, Eucalyptus, Acacia*	Meet Wellards rep on site. Organise for bulldozing again with followup treatment by northern team using quads.
		2. Treatment of plants	No treatment conducted												
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
??.09.11	Hillgrove	1. Inspection of site	Foot survey		1	100		0.01	10	0	2	0	Small infestation in large paddock.	D.sericeum grassland	Repeat inspection in 6 months.
		2. Treatment of plants	Scattered Graslan	Few grams											
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
Jun-11	Campus Creek	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey NA Project officers on site NA		1	100		1	0	0	0	0	Good previous control at this site	Exotic grasses and leucaena along creek. Very dense.	Repeat inspection in 6 months. Make contact with the Townsville council.
03.07.12	Rosebank	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Yes NA		1	100		0.07	0	0	0	0	Site may be considered clean.	Native grasses.	Repeat inspection in 6 months. Speak to local management to maintain checks.
~14.08.12	Toorak	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot surfvey Not required Yes NA		1	100		0.1	0	0	0	0	Site may be considered clean.	*Native grasses.*	Repeat inspection in 6 months. Speak to local management to maintain checks.
~14.08.12	Rosebank	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Yes NA		1	100		0.07	0	0	0	0	Site may be considered clean.	Native grasses.	Repeat inspection in 12 months.
~14.08.12	Campus Creek	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Scattered Graslan, Access at label rates Project officers on site NA	Not specified	2	100 100		1	6	0	0	100	This small patch requires repeat checking over the next 6-12 months.	Introduced grasses, leucaena	Repeat inspection in next 6 months

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
~14.08.12	Helens Hill	1. Inspection of site	Foot survey		1	10	90	0.1	5			0 (dead)	Plants well-treated by Council	Introduced grasses, leucaena	Repeat inspection in next 6 months
		2. Treatment of plants	Not required			0	100								
		3. Discussion with manager	Not required												
		4. Demonstration of practices	NA												
28.08.12	Lansdown 2 (Wellards)	1. Inspection of site	Site visit - no detailed foot survey		3	50	50	2	unknown	~1000?	unknown	80+	Dense, contained infestation. No stock access. Plan developed to co-fund clearing, burn, apply Graslan and complete follow-up spraying. Good start.	Native grasses, mostly Heteropogon, Leucaena . Grasses haying off.	Agreements to be developed between DAFF, TRC and Wellards. Price clearing site. Return visit in next month to maintain momentum.
		2. Treatment of plants	Discussion of methods with Wellards and Townsville Reg council	NA											
		3. Discussion with manager	Development of control plan for the next few years												
		4. Demonstration of practices	Discussion of best methods based on previous experience												
28.08.12	Lansdown 1 (CSIRO)	1. Inspection of site	Foot survey		3	50	50	0.1	~300	0	0	5	Most plants in small contained paddock with occasional plants outside. Plan to be developed with manager and return visit to treat plants.	Exotic grasses and legumes: *Panicum, Brachiaria, Leucaena, Desmanthus, Neonotonia, Urochloa, Senna* . Most mature and still growing.	Return visit to treat plants by cut and spray method plus apply Graslan. Develop plan with manager when he returns.
		2. Treatment of plants	Treatment planning with acting manager	NA											
		3. Discussion with manager	Discussion of management with acting manager												
		4. Demonstration of practices	Discussion of best methods based on previous experience												
04.09.12	Lansdown 1 (CSIRO)	1. Inspection of site	Foot survey		4	50	50	0.1	~300	0	0	5	See previous report. Work completed voluntarily by CSIRO following visit by project officers.	Exotic grasses and legumes: *Panicum, Brachiaria, Leucaena, Desmanthus, Neonotonia, Urochloa, Senna* . Most mature and still growing.	Return visit to check treatment in a few months.
		2. Treatment of plants	Treatment planning with acting manager	Access plus diesel applied basal bark		0	100								
		3. Discussion with manager	Discussion of management with acting manager												
		4. Demonstration of practices	Discussion of best methods based on previous experience												
**.10.13	Hillgrove	1. Inspection of site	Foot survey		1	100		0.1	0	0	0	0	Clean?	D.sericeum grassland	Repeat inspection after seasonal rains.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
**.03.13	Rosebank	1. Inspection of site	Foot survey		1	100		0.02	0	0	0	0	Site may be considered clean.	Native grasses.	Repeat inspection in 12 months.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
**.03.13	Campus Creek	1. Inspection of site	Foot survey		2	100		1	2	0	0	0	Plants flowering but no mature seed.	Introduced grasses, leucaena	Repeat inspection in next 6 months
		2. Treatment of plants	Scattered Graslan	Not specified		100									
		3. Discussion with manager	Project officers on site												
		4. Demonstration of practices	NA												
26.08.13	Helens Hill	1. Inspection of site	Foot survey		0.5	10	90	0.1	0			NA	Plants well-treated by Council. Killed two leucaena.	Introduced grasses, leucaena	Repeat inspection in next 6 months
		2. Treatment of plants	Not required			0	100								
		3. Discussion with manager	Not required												
		4. Demonstration of practices	NA												
10.10.14	Helens Hill	1. Inspection of site	Foot survey		0.5	10	90	0.1	0			NA	Plants well-treated by Council.	Introduced grasses, leucaena	Possible clean. Occasional future checks. Under excellent local control.
		2. Treatment of plants	Not required			0	100								
		3. Discussion with manager	Not required												
		4. Demonstration of practices	NA												
**.05.14	Campus Creek	1. Inspection of site	Foot survey		2	100		1	0	0	0	0	Plants flowering but no mature seed.	Introduced grasses, leucaena	Repeat inspection after seasonal rains.
		2. Treatment of plants	Not required	Not specified											
		3. Discussion with manager	Project officers on site												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
**.08.13	Rosebank	1. Inspection of site	Foot survey		1	100		0.07	0	0	0	0	Site may be considered clean.	Native grasses.	Repeat inspection in 12 months.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
30.08.14	Hillgrove	1. Inspection of site	Foot survey		1	100		0.01	0	0	0	0	Possibly clean.	D.sericeum grassland	Repeat inspection after seasonal rains.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
12.09.14	Southedge RS	1. Inspection of site	Quadbike surveys		1	100		0.01	0	0	0	0	Potentially clean.	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Additional surveying and treatment during/ following 2014/15 wet season.
		2. Treatment of plants	Not required.	NA		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												

Aeschynomene paniculata

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
7-6.06.11	Swan's Lagoon	1. Inspection of site	Quadbike surveys		8	100		0.05	~50	0	0	80	Small plants with a few seeds each. Seed collected and destroyed.	*T. triandra, H.contortus, C.rotundifolia, C.gayana, S.scabra Dense vegetation (not grazed)*	Return in next 8-12 months
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	10 L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
8-9.06.11	Tedlands	1. Inspection of site	Quadbike surveys		30	100		5	~1000	~500	0	80	Most plants hand-pulled, particularly on the islands which could not be accessed previously.	*Imperata, C.gayana, H.contortus, T.quadrivalvis, S.scabra, S.hamata, A.americana, M.pudica, A.histrix*	Return in next 8-12 months
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	60 L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
10.06.11	Granite Vale	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		4	100		0.02	12	0	0	100	Plants hand-pulled and all seed collected	*H. contortus, Urochloa, M. pudica, A. americana, A. brasiliana, Stylosanthes* Vigorous pasture.	Return in next 8-12 months
		2. Treatment of plants	Removed seeds from mature plants and hand-pulled.	NA		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
27.7.11	Southedge RS	1. Inspection of site	Quadbike surveys		12	100		8	500	50	0	80	Most plant seeding and seed colected.	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Return in next 8-12 months
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	60L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
10.08.11	Tedlands	1. Inspection of site	Quadbike surveys		16	100		5	few	~100	0	few mature	Followup visit to control missed plants. Plants chipped out.	*Imperata, C.gayana, H.contortus, T.quadrivalvis, S.scabra, S.hamata, A.americana, M.pudica, A.histrix*	Return October-February
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	10 L		100									
		3. Discussion with manager	Yes. Activity and populations												
		4. Demonstration of practices	No. (already aware)												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
11.08.11	Strathdale	1. Inspection of site	Quadbike surveys		8	100		0.25	60	0	0	100	Spindly plants, affected by frost. Most found below trees on hill.	*H.contortus, B.decumbens, C.gayana, S.sphacelata, Mpudica, S.scabra*	Return October-February
		2. Treatment of plants	Removed mature seeds and hand-pulled mature plants.	0 L (pulled)		100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
25.10.11	Walkamin / MK + SD	1. Inspection of site	Foot survey		12	100		1	~100		0	Most (picked)	Mostly mature plants. Dense grass cover in surrounds.	Dense grass cover. *Stylosanthes, H.contortus,*	Fire to reduce cover.
		2. Treatment of plants	Handpicked seeds, Grazon-DS plus wetter at label rates	Not specified		60	40								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	Limited. Showed plants and control equipment to farm staff.												
07.12.11	Walkamin	1. Inspection of site	Foot survey		12	100		1	30	0	4	0	Cool fire in the core area, but hotter in some areas.	Dense grass cover. *Stylosanthes, H.contortus,*	Followup spray and check
		2. Treatment of plants	Handpicked seeds, Grazon-DS plus wetter at label rates	Not specified		60	40								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	Limited. Showed plants and control equipment to farm staff.												
29.01.11	Walkamin	1. Inspection of site	Foot survey		2	100		1	50	0	0	0	Good control	*Stylosanthes, H. contortus, T. triandra*	Followup checks for missed plants
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus Grazon applied by	5 L		100									
		3. Discussion with manager	Yes. Manager.												
		4. Demonstration of practices	NA												
29.01.11	Walkamin	1. Inspection of site	Foot survey		1	100		1	10	0	5+5	0	Flowering and setting green pods	*Stylosanthes, H. contortus, T. triandra*	Followup checks for missed plants
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus Grazon applied by	2 L		100									
		3. Discussion with manager	Project officers on site												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
30.3.12	Southedge RS	1. Inspection of site	Quadbike surveys		8	100		8	200	0	0	0	Effective treatment	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Return next few months for follow-up treatment.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus glyphosate applied by	100L		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
05.04.12	Southedge RS	1. Inspection of site	Quadbike surveys		8	100		8	200	0	0	0	Effective treatment	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Return by end of year.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus glyphosate applied by	60L		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
24.04.12	Granite Vale	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		4	100		0.02	20	25	0	25 (pulled)	Vigorous pasture	*H. contortus, Urochloa, M. pudica, A. americana, A. brasiliana, Stylosanthes*	Return October-February
		2. Treatment of plants	Removed seeds from mature plants and hand-pulled.	NA		100									
		3. Discussion with manager	Showed site and plants to Joe Olive, new owner.												
		4. Demonstration of practices	Demonstrated on site.												
26-27.04.12	Tedlands	1. Inspection of site	Quadbike surveys		12	100		5	core area 200, islands 300	50	0	few mature	Very dense vegetation making detection difficult in the core area	*Imperata, C.gayana, H.contortus, T.quadrivalvis, S.scabra, S.hamata, A.americana, M.pudica, A.histrix*	Return October-February
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	140 L		100									
		3. Discussion with manager	Yes. Activity and populations												
		4. Demonstration of practices	No. (already aware)												
28.04.12	Strathdale	1. Inspection of site	Quadbike surveys		8	100		0.25	100	0	0	15	Vigorous pasture, but grazing eased detection. Most plants vegetative or flowering.	*H.contortus, B.decumbens, C.gayana, S.sphacelata, Mpudica, S.scabra*	Return October-February
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	20 L		100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
29.05.12	Southedge RS	1. Inspection of site	Quadbike surveys		8	100		8	few	100	0	80	Plants still growing following late wet season. Most plants pulled.	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Return one month after significant rainfall.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus glyphosate applied by	60L		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
26.06.12	Walkamin	1. Inspection of site	Foot survey		2	100		1	0	0	0	0	Most plants around logs where there had been a fire previously. Plants spindly and growing vigorously.	*Stylosanthes, H. contortus, T. triandr.* Difficult to detect plants in dense pasture.	Return one month after significant rainfall.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus glyphosate applied by	20 L		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
29.08.12	Swans Lagoon	1. Inspection of site	Foot survey of core fenced paddocks/GPS points.		4	100	0	0.05	6	0	0	100	Very dense vegetation, some frost damage. Good progress at the site.	Dense, ungrazed pasture. *Themeda, Heteropogon, Stylosathes, Chamaecrista.*	Return visit a few months after significant rainfall. Report to Paul Naughtin.
		2. Treatment of plants	Collect seeds. Hand-pull plants.												
		3. Discussion with manager	Manager not available. Diuscussion with Head Farmhand.												
		4. Demonstration of practices	Demonstrated of plants and control to Head Farmhand.												
11.11.12	Swans Lagoon	1. Inspection of site	Foot survey and transects to determine grazing.		3	100	0	0.05	NA	NA	NA	0	Site grazed heavily during April/May. Fire through part of block previous November. Plants heavily grazed - back to crowns (close to 100%). Owner pleased to not treat.	*Heteropogon contortus, Bothriochloa pertusa, Stylosanthes scabra.*	Return April to measure plant growth and grazing after wet.
		2. Treatment of plants	NA - not for control	NA											
		3. Discussion with manager	Yes. Sit-down discussion and on-site inspection.												
		4. Demonstration of practices	NA												
31.01.13	Galloway Plains	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.05	0	0	0	0	No plants	Native grasses	Follow-up check June-December
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
27.03.13	Walkamin	1. Inspection of site	Foot survey		3	100		1	1500	0	0	0 (green pods only)	Most plants around logs where there had been a fire previously. Plants spindly and growing vigorously. Most flowering with immature pods.	*Stylosanthes, H. contortus, T. triandr.* Difficult to detect plants in dense pasture.	Return one month after significant rainfall.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye plus glyphosate applied by	80 L		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
20.05.13	Tedlands	1. Inspection of site	Quadbike surveys		12	100		5	core area 150, islands 500	core area 50-100, islands 50	0	20	Very dense vegetation making detection difficult in the core area. Seeds not yet shedding, many immatute. Seeds bagged and burnt.	*Imperata, C.gayana, H.contortus, T.quadrivalvis, S.scabra, S.hamata, A.americana, M.pudica, A.histrix*	Return August-November
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	110 L								seeds bagged			
		3. Discussion with manager	Yes. Activity and populations												
		4. Demonstration of practices	No. (already aware)												
21.05.13	Granite Vale	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		4	100		0.02	1	0	0	0	Vigorous pasture	*H. contortus, Urochloa, M. pudica, A. americana, A. brasiliana, Stylosanthes*	Return October-February
		2. Treatment of plants	Removed seeds from mature plants and hand-pulled.	NA		100									
		3. Discussion with manager	Showed site and plants to Joe Olive, new owner.												
		4. Demonstration of practices	Demonstrated on site.												
21-22.05.13	Strathdale	1. Inspection of site	Quadbike surveys		8	100		0.25	Tree: 140 Trees: 150	15	0	2	Vigorous pasture, but grazing eased detection. Most plants vegetative or flowering.	*H.contortus, B.decumbens, C.gayana, S.sphacelata, Mpudica, S.scabra*	Return October-February
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	10L		100						seeds bagged			
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
25.06.13	Walkamin	1. Inspection of site	Foot survey		4	100		1	100	0	0	100	Return treatment in main site. A few plants found in the adjoining Forestry paddock (5 m in).	*Stylosanthes, H. contortus, T. triandr.* Difficult to detect plants in dense pasture.	Return one month after significant rainfall.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and hand-stripping	20 L		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
01.08.13	Southedge RS	1. Inspection of site	Quadbike surveys		12	100		8	550	10	0	25	Chipped most plants after removing seeds. New ownership. Many seedlings.	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Return by end of year.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and hand-stripping	10L (small plants)		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
27.08.13	Tedlands	1. Inspection of site	Foot survey		8	100		5	core area 80, islands 10+10+60	5	0	50	Excellent control previous visit. Site dry. Seeds bagged and burnt.	*Imperata, C.gayana, H.contortus, T.quadrivalvis, S.scabra, S.hamata, A.americana, M.pudica, A.histrix*	Return after wet season.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by handsprayer to	12 L								seeds bagged			
		3. Discussion with manager	Yes. Activity and populations												
		4. Demonstration of practices	No. (already aware)												
28.08.13	Strathdale	1. Inspection of site	Foot survey		2	100		0.25	Hill: 30 Trees: 6	0	0	1	Excellent control previous visit. Site dry. Seeds bagged and burnt.	*H.contortus, B.decumbens, C.gayana, S.sphacelata, Mpudica, S.scabra*	Return after wet season.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by handsprayer to	0.5 L		100						seeds bagged			
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
28.08.13	Eungi	1. Inspection of site	Foot survey		2	100		0.05	0	0	0	0	Dry. Indian couch dominating.	*B. pertusa, C. ciliari, Carissas*	Site considered clean.
		2. Treatment of plants	Not required	NA											
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												
28.08.13	Havilah	1. Inspection of site	Foot survey		2	100		0.05	0	0	0	0	Very dry. High biomass buffel (4000 kg/ha?). Indian couch invading where it can.	*B. pertusa, C. ciliari, Carissas. Desmanthus* (grazed)	Site considered clean.
		2. Treatment of plants	Not required	NA											
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
22.01.14	Galloway Plains	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.05	0	0	0	0	No plants	Native grasses	Follow-up check June-December
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
17-20.03.14	Strathmay	1. Inspection of site	Quadbike and foot surveys, GPS logging.		50	30	70	10	~5000	~10000	?	70	New, previously uncontrolled infestation. Considered 5-10 years old. Full area not defined. Many plants over 2 m.	*H. contortus* grasslands; *Eucalyptus, Corymbia, Grevillea*	Urgent return to control known plants and survey high risk areas.
		2. Treatment of plants	Grazon-DS@350mL/100L equivalent plus wetter and dye applied by quadbike to young	~300 L								mostly green			
		3. Discussion with manager	Under QPWS management. Present.												
		4. Demonstration of practices	Yes: identification, surveying and control.												
~10.06.14	Walkamin	1. Inspection of site	Foot survey		4	100		1	500	0	0	100	Seeded plants were bagged. Still reen enough to spray.	*Stylosanthes, H. contortus, T. triandr.* Difficult to detect plants in dense pasture.	Return one month after significant rainfall (storms).
		2. Treatment of plants	Grazon-DS@350mL/100L equivalent plus wetter and hand-stripping	20 L		100						seeds bagged			
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
24-28.06.14	Tedlands	1. Inspection of site	Foot survey		8	100		5	core area 200, islands 200	few	0	50	Actively growing following good rainfall.	*Imperata, C.gayana, H.contortus, T.quadrivalvis, S.scabra, S.hamata, A.americana, M.pudica, A.histrix*	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by handsprayer to	180 L		100						seeds bagged			
		3. Discussion with manager	Yes. Activity and populations												
		4. Demonstration of practices	No. (already aware)												
24-28.06.14	Strathdale	1. Inspection of site	Foot survey		5	100		0.25	Hill: 400 Trees: 5 Arena: 60	0	0	0	Excellent control previous visit. Site dry. Seeds bagged and burnt.	*H.contortus, B.decumbens, C.gayana, S.sphacelata, Mpudica, S.scabra*	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by handsprayer to	10 L		100						green pods			
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
24-28.06.14	Granite Vale	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		4	100		0.02	0	0	0	0	Vigorous pasture	*H. contortus, Urochloa, M. pudica, A. americana, A. brasiliana, Stylosanthes*	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Not required	NA		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
26-30.04.14	Strathmay	1. Inspection of site	Quadbike and foot surveys, GPS logging.		128	0	100	2	few	~8000	few	70	Checking of area along river first sprayed and large areas adjacent to lagoon (not sprayed previously).	*H. contortus* grasslands; *Eucalyptus, Corymbia, Grevillea*	Followup surveying in surrounding areas, particularly outside laggon infestation and across Coleman River.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	unknown								mostly green			
		3. Discussion with manager	Under QPWS management. Present.												
		4. Demonstration of practices	Yes: identification, surveying and control.												
21-24.07.14	Strathmay	1. Inspection of site	Quadbike and foot surveys, GPS logging.		24	20	80	10	1000	few	few	70	Previous treatment highly effective. Further surveying required, particularly on far side of the Colemen River (from house).	*H. contortus* grasslands; *Eucalyptus, Corymbia, Grevillea*	Additional surveying and treatment during/ following 2014/15 wet season.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	50 L								mostly green			
		3. Discussion with manager	Under QPWS management. Present.												
		4. Demonstration of practices	Yes: identification, surveying and control.												
12.09.13	Southedge RS	1. Inspection of site	Quadbike surveys		12	100		8	600	0	0	50	Many mar=ture plants and seed shed.	*T.triandra, H.contortus. B.decumbens, S.scabra, Melaleuca* Dense vegetation	Return by end of year.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and hand-stripping	120L (small plants)		100									
		3. Discussion with manager	No												
		4. Demonstration of practices	No												

Indigofera schimperi

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
12.08.11	Oxford Downs	1. Inspection of site	Quadbike surveys. Thorough inspection of creeks		2	100		0.5	50 (frosted)	Difficult to determine	0	5	Plants severely frosted.	*P.decompositum, B.pertusa, D.sericeum, R.minima, Neptunia, C.ternatea, D.virgatus, I.spicata*	Return February-April
		2. Treatment of plants	No treatment because site severely frosted.		2	100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	Limited. Showed plants and control equipment to farm staff.												
28.04.12	Oxford Downs	1. Inspection of site	Quadbike surveys		2	100		0.5	50+100. some may have been missed	Difficult to determine	0	5	Most plants seeedlings or flowering. Easy to detect in grazed pasture.	*P.decompositum, B.pertusa, D.sericeum, R.minima, Neptunia, C.ternatea, D.virgatus, I.spicata*	Return October-February
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by quadbike to young	20 L	2	100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	Limited. Showed plants and control equipment to farm staff.												
13.06.12	Wrotham Park	1. Inspection of site	Foot survey		2	100		0.5	Sus. 5	0	0	0		Native grass plain	Return one month after significant rainfall.
		2. Treatment of plants	Grazon-DS + wetter and glyphosate	NA											
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
22.05.13	Oxford Downs	1. Inspection of site	Quadbike surveys		2	100		0.5	13+185 some may have been missed	Difficult to determine	0	10	Most plants seeedlings or flowering. Some older missed plants down-slope of area (50 m). Very dense grass. *Parthenium* now dominating site - no further quad access.	*P.decompositum, B.pertusa, D.sericeum, R.minima, Neptunia, C.ternatea, D.virgatus, I.spicata*	Return October-February
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by handspray to young	20 L	2	100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	Limited. Showed plants and control equipment to farm staff.												
02.07.13	Wrotham Park	1. Inspection of site	Foot survey		2	100		0.5	0	0	0	0		Native grass plain	Return one month after significant rainfall.
		2. Treatment of plants	Grazon-DS + wetter and glyphosate	NA											
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
28.08.13	Willunga	1. Inspection of site	Foot survey		2	100		0.5	3	0	0	100	Dry. Desmanthus growing well.	*C. ciliaris Desmanthus, S. scabra*	Return after wet season.
		2. Treatment of plants	Grazon-DS + wetter and glyphosate	NA											
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
28.08.13	Oxford Downs	1. Inspection of site	Foot survey		1	100		0.5	site 1: 1 plant Site 2: 12 pl	0	0	0	Excellent treatment previous visit. Dry.	*P.decompositum, B.pertusa, D.sericeum, R.minima, Neptunia, C.ternatea, D.virgatus, I.spicata*	Return after wet season.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by handspray to young	0.5 L	1	100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	Limited. Showed plants and control equipment to farm staff.												
28.08.13	Myuna	1. Inspection of site	Foot survey		2	100		0.5	0	0	0	0	Uncertain location of trial site. Found no legumes over a large area. Very dry.	*C. ciliari,s*	Check site location.
		2. Treatment of plants	Not required	NA											
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												
22.01.14	Galloway Plains	1. Inspection of site	Inspection of original surveyed area. Completed on foot.		1	100		0.05	0	0	0	0	No plants	Native grasses	Follow-up check June-December
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
24-28.06.14	Oxford Downs	1. Inspection of site	Quadbike surveys. Thorough inspection of creeks		2	100		0.5	6 plants	0	0	0	Previous treatments highly effective.	*P.decompositum, B.pertusa, D.sericeum, R.minima, Neptunia, C.ternatea, D.virgatus, I.spicata*	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Grazon-DS@1L/100L equivalent plus wetter and dye applied by handsprayer to	1 L	2	100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	Limited. Showed plants and control equipment to farm staff.												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
23-27.05.11	Brian Pastures site 1	1. Inspection of site	Foot survey		1	100		3	High density	0	0	Most mature plants		Not specified	Burn site and spray thereafter.
		2. Treatment of plants	NA	NA		0	100								
		3. Discussion with manager	Yes. Tracy Longhurst												
		4. Demonstration of practices	Yes												
23-27.05.11	Brian Pastures site 2	1. Inspection of site	Foot survey		1	100		2	20	0	0	some mature	No plants in tree area - near gate	Not specified	Continue local control. Visit in 6 months time.
		2. Treatment of plants	Grazon plus wetter at label rates.	<5L		0	100								
		3. Discussion with manager	Yes. Tracy Longhurst												
		4. Demonstration of practices	Yes												
23-27.05.11	Brian Pastures site 3 (new) Old basalt COPE site, nursery & des. grazing trial.	1. Inspection of site	No		1		100	2	Not specified				Greg will continue local control	Not specified	Continue local control. Visit in 6 months time.
		2. Treatment of plants	Glyphosate at label rates	Not specified		0	100								
		3. Discussion with manager	Yes. Greg Euler												
		4. Demonstration of practices	Yes												
23-27.05.11	Kapalee	1. Inspection of site	Foot survey		2	100		0.02	Not specified			Yes	Haevily grazed site. IS small with mature pods. One escapee 200 m from old plots.	Pangola and Rhodes grasses mostly, grazed.	Return in 6 months.
		2. Treatment of plants	Spraying not possible. Cut to ground level, seeds removed and Graslan applied.			100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
23-27.05.11	Valencia	1. Inspection of site	Foot survey		2	100		0.5	30	0	0	20	Site frosted	Good growth of clitoria, desmanthus, caatinga stylo, macroptilium and *Centrosema schottii*	Return in 6 months.
		2. Treatment of plants	Spraying not possible. Cut to ground level, seeds removed and Graslan applied.	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
23-27.05.11	Mutation	1. Inspection of site	Foot survey		4	100		0.5	~200	0	0	Most mature plants	One escapee 100 m from core site. Population expanded with wet year.	Good growth of clitoria, desmanthus, caatinga stylo and leucaena.	Need to remove leucaena plots and cultivate
		2. Treatment of plants	Graslan pellets scattered	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
23-27.05.11	Emerald RS	1. Inspection of site	Foot survey		2	100		0.1	Frequent in grass			Many	No local treatment by Emerald Agricultural College (EAC). There are plans to sell the station.	Sesbania.	Speak to pest officer of EAC. Site needs to be slashed and burnt and cultivated.
		2. Treatment of plants	No treatment possible this visit.												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
23-27.05.11	Juanita', Fernlees	1. Inspection of site	Foot survey		1	100		sus. 0.1	0	0	0	0	Check site previously sown to IS but found clean. Still is.	Burgundy bean, siratro, desmanthus, clitoria plus Qld bluegrass	Visit again by end of project
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
23-27.05.11	Birrong	1. Inspection of site	Foot survey		2	100		0.2	30	0	0	0	Plants 50 cm tall and some tips grazed. Only found at the first site (leucaena plot).	Clitoria, Caatinga stylo and leucaena persistent. Purple pigeon grass.	Return in 6 months.
		2. Treatment of plants	Graslan pellets scattered	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
23-27.05.11	Rangeview	1. Inspection of site	Foot survey		3	100		0.1	Not specified			20%	IS in range of sizes, with large plants carrying mature seeds (likely survived spraying during dry conditions). No seedlings in bare Graslan patches	Purple pigeon grass.	Return in 6 months.
		2. Treatment of plants	Graslan	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
23-27.05.11	Kookaburra	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey None possible this visit Yes. Yes.	Inspection on site.	2	100			Not specified			0	Surface washed by summer rainfall. Haevily grazed.	Not specified	Return as soon as conditions allow.
29.8.11 - 2.09.11	Holyrood	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		2	100		0.5	0	0	0	0	Heavily grazed. Previous visit (Feb 2011) had 10 seedlings following summer rainfall.	Buffel, Caating and Seca stylo and desmanthus - dry.	Return in 6 months.
29.8.11 - 2.09.11	Kiamanna	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		1	100		0.1	0	0	0	0	Previous Graslan treatments in Feb. 2011 seem to have been effective.	Buffel grass, dense.	Return in 6 months.
29.8.11 - 2.09.11	Rangeview	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Graslan to both leucaena plots. Yes. Discussion with owners and plans for management. No.	Not specified.	2	100 100		0.1	Not specified		27	some mature	Good cooperation from owners. IS plants dry and brittle. 24 seeding plants found in laneway and 2 along fence.	Purple pigeon grass, dry.	Will bulldoze leucaena for cultivation.
29.8.11 - 2.09.11	Ellenvale	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		1	100			0	0	0	0	No plants	Qld bluegrass, Bambatsi, Bisset, buffel with desmanthus	Return in 6 months.

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants1	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
14.09.11	Norton (RS)	1. Inspection of site	Foot survey		2	100		0.1	2	0	0	Yes - bagged	First seeding for years - hopefully collected all seeds	Not specified	Return in 6 months.
		2. Treatment of plants	Dug up			100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
20.10.11	Brian Pastures site 1	1. Inspection of site	Foot survey		2	100		3	High density	0	0	0	Paddock has been burnt as requested	Not specified	Spot spray locally.
		2. Treatment of plants	Grazon plus wetter at label rates.	<5L		100									
		3. Discussion with manager	Yes. Tracy Longhurst												
		4. Demonstration of practices	No												
20.10.11	Brian Pastures site 2	1. Inspection of site	Foot survey		2	100		2	50+30	0	0	0	Paddock was not burnt (not enough fuel)	Not specified	Continue local control. Visit in 6 months time.
		2. Treatment of plants	Grazon plus wetter at label rates.	<5L		50	50								
		3. Discussion with manager	Yes. Tracy Longhurst												
		4. Demonstration of practices	No												
20.10.11	Brian Pastures site 3 (new) Old basalt COPE site, nursery & des. grazing trial.	1. Inspection of site	No		local		100	2	3				Greg will continue local control	Not specified	Continue local control. Visit in 6 months time.
		2. Treatment of plants	Glyphosate at label rates	Not specified			100								
		3. Discussion with manager	Yes. Greg Euler												
		4. Demonstration of practices	No												
25.10.11	Brian Pastures site 1	1. Inspection of site	No - phone call		local	50	50	3	Not specified	0	0	0	Under local control	Not specified	Follow up visit
		2. Treatment of plants	Cultivation for fallow and planting oats in April/May 2012	NA		0	100								
		3. Discussion with manager	Yes. Tracy Longhurst												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
25.10.11	Brian Pastures site 2	1. Inspection of site	No - phone call		local	50	50	2	Not specified	0	0	0	Under local control	Not specified	Follow up visit
		2. Treatment of plants	Cultivation for fallow and planting oats in April/May 2012	NA		0	100								
		3. Discussion with manager	Yes. Tracy Longhurst												
		4. Demonstration of practices	No												
28.10.11	Kapalee	1. Inspection of site	Foot survey		2	100		0.02	23	0	0	0		High populations of desmanthus and smaller populations of butterfly pea and Caatinga stylo.	Return in 6 months.
		2. Treatment of plants	Grazon plus wetter at label rates.	<5L		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
28.10.11	Rangeview	1. Inspection of site	Foot survey		5	100		0.1	150+1250	12 (outside)		Few	IS plants had some yellowing. Seedlings looked healthy. No plants found in the gully as in previous visits.	Dense purple pigeon plus dfesmanthus, Caatinga stylo and butterfly pea.	Return in 6 months.
		2. Treatment of plants	Grazon plus wetter at label rates.	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
24.10.11	Rolfe Park	1. Inspection of site	Foot survey		4	100		0.01	200	0	0	0	IS spread throughout buffel	Buffell	Return in 6 months.
		2. Treatment of plants	Grazon plus wetter at label rates.	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
24.10.11	Valencia	1. Inspection of site	Foot survey		1	100			0	0	0	0	Heavily frosted last winter	Not specified	Return in 6 months.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
7.11.11 - 11.11.11	Galloway Plains	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		1	100			0	0	0	0	No plants.	Forset and desert bluegrasses plus Indian couch, sabi grass and natives. Seca dominant with some desmanthus.	Return in next 12 months
7.11.11 - 11.11.11	Sorrell Hills	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Grazon plus wetter at label rates. Graslan pellets. Visit purposes only. NA	<10L	3	100 100			54	0	A few	0	Some plants regrowing fromn previoius treatments. Basal shoots. Some dead patches from Graslan.	Well grazed. Native grasses.	Return in 6 months.
7.11.11 - 11.11.11	Mutation	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Graslan Yes. Spoke to station worker and planned future control. No	Not specified	4	100 100		~2500 + 40	0.5			Many	Green branches plus dead. Site grazed.	Native grasses. Dense plots of caatinga,desmanthus abd butterfly pea	To spray site and cultivate in future.
7.11.11 - 11.11.11	Carramah	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Cultivation with oats cropped in 2010. Grazed since. Grazon plus wetter at label Visit purposes only. No	<5L	3	100 0	100	0.1	59	0	0	0	One large plant found beside fence.	*Brachiara* invading site. Parthenium present.	Requires further cultivation.
7.11.11 - 11.11.11	Goondooroo	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Grazon extra plus wetter at label rates. Visit purposes only. No	Not specified	4	100 100			200 + 60			Many	IS spreading within plot and 200 m downslope.	Not specified	Return in 6 months.

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
7.11.11 - 11.11.11	Birrong	1. Inspection of site	Foot survey		2	100		0.2	40+5		Some	some mature	Scattered plants.	Leucaena (pushed)	Return in 6 months.
		2. Treatment of plants	Grazon plus wetter at label rates. Graslan pellets.	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
7.11.11 - 11.11.11	Emerald RS	1. Inspection of site	Foot survey		1	100		0.1	Not specified			Most plants	Still no management by EAC.	Dense ungrazed grass	Contact managers urgently.
		2. Treatment of plants	No treatment possible this visit.												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
18-20.01.12	Brigalow RS	1. Inspection of site	Foot survey		3	100			Total of 71	0	0	80	5 of 8 original plots contain plants (a decrease from 2010). No grazing.	Previously cultivated. Dense grass cover as sesbania seems to be losing dominance.	Site to be sold in near future. Site requires slashing, spraying and cultivation.
		2. Treatment of plants	Large plants snapped off and Graslan pellets scattered	Not specified		100									
		3. Discussion with manager	Yes. Steve O'Connor and David Lack notified of plants and plans.												
		4. Demonstration of practices	No												
18-20.01.12	Rangeview	1. Inspection of site	Foot survey		3	100		0.1	31 + a few more	0	0	0%	IS in range of sizes, with most carrying green seed pods. None found in gully. There are dead plants from previous Graslan applications. No seedlings in bare Graslan patches	Purple pigeon grass, dense. No obvious grazing.	Remove leucaena trash allowing boom spraying. Return in 6 months including inspections along the gully.
		2. Treatment of plants	Site renovation and Graslan scattered.	Leucaena pushed over as planned, but not yet removed.		50	50								
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
18-20.01.12	Birrong	1. Inspection of site	Foot survey		3	100		0.2	45	0	0	0	Plants 30 cm tall and some tips grazed. No plants found outside leucaena plot. Part of cell-grazre system: owners report plants in other paddocks. Note: owners happy with IS.	Clitoria, Caatinga stylo and leucaena persistent. Purple pigeon grass.	Check other paddocks with owners. Followup on owners statements that IS is not a problem and no further control required.
		2. Treatment of plants	All plants removed by hoe and Graslan scattered.	Not specified		100									
		3. Discussion with manager	Discussion of plants with owners. See notes.												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
18-20.01.12	Carramah	1. Inspection of site	Foot survey		2	100		0.1	8	0	1	0	One large plant found beside fence.	*Brachiara* invading site. Parthenium present.	Under good management. Return in 6 months.
		2. Treatment of plants	Site sprayed in preparation for cultivation. IS plants dug out and and Graslan scattered.	Not specified		20	80								
		3. Discussion with manager	Yes. Progress of site management.												
		4. Demonstration of practices	No												
18-20.01.12	Mutation	1. Inspection of site	Foot survey		3	100		0.5	~200	0	0	Green pods.	Four old patches. Grazon seems to have had a limited effect on the overall population but killed old plants.	Good growth of clitoria, desmanthus, caatinga stylo and leucaena.	Still need to remove leucaena plots and cultivate
		2. Treatment of plants	Graslan	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
07.02.12	Ellenvale	1. Inspection of site	Foot survey		1	100		0.01	4	0	0	25	Vigorous growth of companion grasses, including *Urochloa mosambicensis* and *Bothriovchloa insculpta* . Desmanthus and stylo seabrana also growing well.	Qld bluegrass, Bambatsi, Bisset, buffel with desmanthus	Return in 6 months.
		2. Treatment of plants	Dug up. Graslan appled.												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
16.04.12	Holyrood	1. Inspection of site	Foot survey		2	100		0.5	1	0	0	0	Heavily grazed, now spelled.	Buffel, Caating and Seca stylo and desmanthus - dry.	Return in 6 months.
		2. Treatment of plants	Plants dug out and Graslan acattered.												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	No												
16.04.12	Emerald RS	1. Inspection of site	Foot survey		1	100		0.1	Not specified			Most plants	Still no management by EAC. RS may have been sold to a private buyer who needs to be advised of potential long-term problem.	Dense ungrazed grass	Site needs burning/ slashing/ cultivation. Contact managers urgently.
		2. Treatment of plants	No treatment possible this visit.												
		3. Discussion with manager	No												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
17.04.12	Valencia	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey For owner Yes. Site inspected with owner. Yes. Owner shown 6 plants and location for future control.		1	100			6	0	0	100	Bare areas from 2010 Graslan treatments still evident. Plants may have been missed last time because of officer unsure of exxcat site location.	Not specified	Return in 6 months.
17.04.12	Carramah	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Not inspected due to time constraints. Site sprayed in early April in preparation of cropping. Visit purposes only. No	Not specified	NA	0	100	0.1	?	?	?	?		*Brachiara* invading site. Parthenium present.	Requires further cultivation.
18.04.12	Kiamanna	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Plants dug out and Graslan acattered. Visit purposes only. No	Not specified	2	100 100		0.1	1	0	0	0	Site well-grazed. Many leucaena plants dead or dying.	Buffel grass, dense.	Return in 6 months.
21.09.12	Holyrood	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		2	100		0.5	0	0	0	0	Dry. Buffel grazed to 10-15 cm. Buffel beginning to encroach on Graslan areas.	Buffel, Caating and Seca stylo and desmanthus - dry.	Return in 6 months.
30.11.12	Ellenvale	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		1	100			0	0	0	0	Heavy grazed and dry. Desmanthus, seabrana and leucaena growing well under heavy grazing.	Qld bluegrass, Bambatsi, Bisset, buffel with desmanthus	Return in 6 months.

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
06.05.13	Kiamanna	1. Inspection of site	Foot survey		2	100		0.1	0	0	0	0	Site well-grazed with cattle still present. Patches treated with Graslan still bare	Buffel grass, dense.	Return in 6 months.
		2. Treatment of plants	Not required	Not specified		100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												
06.05.13	Carramah	1. Inspection of site	Foot survey		NA	100		0.1	0	0	0	0	Butterfly pea and burdundy bean present. Parthenium dense along eastern fenceline.	*Brachiara* invading site. Parthenium present.	Return in 6 months.
		2. Treatment of plants	Site sown to wheat and weeds controlled uising herbicides.	Not specified		0	100								
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												
15.05.13	Emerald RS	1. Inspection of site	Foot survey		1	100		0.1	Not specified			Most plants	No control by new managers.	Dense ungrazed grass	Site needs burning/ slashing/ cultivation. Contact managers urgently.
		2. Treatment of plants	No treatment possible this visit.												
		3. Discussion with manager	No												
		4. Demonstration of practices	No												
15.05.13	Valencia	1. Inspection of site	Foot survey		1	100			2	0	0	0 (few green pods)	Bare areas from 2010 Graslan treatments still evident. Plants may have been missed last time because of officer unsure of exxcat site location.	Not specified	Return in 6 months.
		2. Treatment of plants	Hand pulled and Graslan pellets scattered in plots	Few grams											
		3. Discussion with manager	Yes. Site inspected with owner. Plants shown to manager.												
		4. Demonstration of practices	No.												
19.05.13	Holyrood	1. Inspection of site	Foot survey		2	100		0.5	0	0	0	0	Very dry season. Buffel grazed to 10-15 cm.	Buffel, Caating and Seca stylo and desmanthus - dry.	Return in 6 months.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
19.05.13	Ellenvale	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		1	100			0	0	0	0	Very dry season. Heavy grazed and dry when visited. Desmanthus, seabrana and leucaena growing well under heavy grazing.	Qld bluegrass, Bambatsi, Bisset, buffel with desmanthus	Return in 6 months.
2012_13	Birrong	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	No Local control. Glyphoaste at label rates. Visit purposes only. No	Not specified	2	100 100		0.2	30	0	0	0	Plants under local control (spot-spraying) following a change of heart (originally not concerned, now controlling it in cell blocks).	Clitoria, Caatinga stylo and leucaena persistent. Purple pigeon grass.	Return in 6 months.
2012_13	Kookaburra	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	No Local control. Glyphoaste at label rates. Yes. Yes.	Inspection on site.	2	100			unknown			0	Local control (spot spraying).	Not specified	Return as soon as conditions allow.
xx.01.13	Sorrell Hills	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit purposes only. NA		3	100 100			0	0	0	0	No plants found.	Well grazed. Native grasses.	Return in 6 months.
22-24.07.13	Kapalee	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Grazon plus wetter at label rates. Visit purposes only. No	<1 L	2	100 100		0.02	32	19	0	8	Dense grass seems to be reducing IS growth	High populations of desmanthus and smaller populations of butterfly pea and Caatinga stylo.	Return in 6 months.

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
22-24.07.13	Rangeview	1. Inspection of site	Foot survey		3	50	50	0.1	120	0	0	0%	Good result in cultivated areas. Some plants found around the edges and treated.	Winter cereals	Return in 6 months.
		2. Treatment of plants	Grazon at label rates. Cultivation and spraying during cropping	Not specified		50	50								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
22-24.07.13	Brian Pastures site 1	1. Inspection of site	Foot survey		1	50	50	3	60	0	0	Most mature plants	Good local control	Not specified	Burn site and spray thereafter.
		2. Treatment of plants	Cultivated, slashed, sprayed	NA		50	50						Population reducing		
		3. Discussion with manager	Yes. Tracy Longhurst (manager) and farmhands												
		4. Demonstration of practices	Yes												
22-24.07.13	Brian Pastures site 2	1. Inspection of site	Foot survey		1	50	50	2	25	0	0	some mature		Not specified	Continue local control. Visit in 6 months time.
		2. Treatment of plants	Grazon plus wetter at label rates.	<5L		50	50						Good local control		
		3. Discussion with manager	Yes. Tracy Longhurst												
		4. Demonstration of practices	No												
22-24.07.13	Brian Pastures site 3 (new) Old basalt COPE site, nursery & des. grazing trial.	1. Inspection of site	No		1	50	50	2	Not specified				Good local control	Not specified	Continue local control. Visit in 6 months time.
		2. Treatment of plants	Glyphosate at label rates	Not specified		50	50								
		3. Discussion with manager	Yes. Greg Euler												
		4. Demonstration of practices	No												
11.03.14	Norton	1. Inspection of site	Foot survey		2	100		0.1	0	0	0	0	Very dry	Not specified	Return after rain.
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
21.05.14	Rangeview	1. Inspection of site	Foot survey		3	30	70	0.1	2 plants	0	0	100 (bag)	Leucaena plants now pushed allowing cultivation of sites. No seedlings. Two seeding plants 30 m from wire gate (pulled and bagged).	Winter cereals	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Dug up and seeds bagged and destroyed.			30	70								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
26.05.2014	Ellenvale	1. Inspection of site	Foot survey		1	100			0	0	0	0	Dry and heavily grazed.	Qld bluegrass, Bambatsi, Bisset, buffel with desmanthus	Possibly clean. Occasional future checks for new plants.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												
27.05.2014	Holyrood	1. Inspection of site	Foot survey		2	100		0.5	0	0	0	0	Well grazed. Continued dry conditions.	Buffel, Caating and Seca stylo and desmanthus - dry.	Possibly clean. Occasional future checks for new plants.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												
27.05.2014	Kiamanna	1. Inspection of site	Foot survey		2	100		0.1	0	0	0	0	Good late-autumn rainfall produced dense pasture.	Buffel grass, dense.	Possibly clean. Occasional future checks for new plants.
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Visit purposes only.												
		4. Demonstration of practices	NA												
2013-14	Birrong	1. Inspection of site	No		2	10	90	0.2	30	0	0	0	Plants under local control (spot-spraying) following a change of heart (originally not concerned, now controlling it in cell blocks).	Clitoria, Caatinga stylo and leucaena persistent. Purple pigeon grass.	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Local control. Glyphoaste at label rates.	Not specified		10	90								
		3. Discussion with manager	Could not visit.												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
2013-14	Goondooroo	1. Inspection of site	Foot survey		4	10	90		unknown			Many	Need to complete check by end of project..	Not specified	return by end of project.
		2. Treatment of plants	Local control. Grazon-DS at label rates.	Not specified		10	90								
		3. Discussion with manager	Could not visit.												
		4. Demonstration of practices	No												
18.05.2014	Emerald RS	1. Inspection of site	Foot survey		1	100	0	0.1	Not specified	Frequent		Most plants	Drovers through site resulting in heavy grazing and nipping-off of mature plants. Some spread within the paddock. Not treated in recent years. Managers understand need to control.	Dense ungrazed grass	Recommend control with selective herbicides and cultivation. Council has a large truck-spraying rig. However, priority likely on declared weeds (parthenium).
		2. Treatment of plants	No treatment possible this visit.			0	0								
		3. Discussion with manager	Meeting with Cental Highlands Reg. Council plus site inspection.												
		4. Demonstration of practices	Yes. On site and development of a control plan.												
28.05.2014	Valencia	1. Inspection of site	Foot survey		1	100	0		1 plant	0	0	0 (few green pods)	Good pasture cover. Site well under control.	Not specified	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Hand pulled and Graslan pellets scattered in plots	Few grams		100	0								
		3. Discussion with manager	Yes. Site inspected with owner. Plants shown to manager.												
		4. Demonstration of practices	No.												
28.05.2014	Carramah	1. Inspection of site	Foot survey		NA	100		0.1	0	0	0	0	Excellent control in the cropping area and no signs of plants in well-grazed surrounds.	*Brachiara* invading site. Parthenium present.	Possibly clean. Occasional future checks for new plants.
		2. Treatment of plants	Site sown to sorghum and weeds controlled uising herbicides.	Not specified		0	100								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
28.05.2014	Mutation	1. Inspection of site	Foot survey		3	100		0.5	~100	0	0	0	Four old patches. Plant population continues to decline.	Good growth of clitoria, desmanthus, caatinga stylo and leucaena.	Future checks for establishment and control of any new plants.
		2. Treatment of plants	Graslan	Not specified		100									
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
28.05.2014	Myuna	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Yes NA	NA	2	100		0.5	0	0	0	0	Owner (Tony Menkens) requested leucaena be killed. No Indogofera plants found.	*C. ciliari,s*	Possibly clean. Occasional future checks for new plants.
3.06.14	Havilah	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Yes. NA	NA	2	100		0.5	0	0	0	0	Dense buffel grass and Marc-type desmanthus and some butterfly pea.	*C. ciliari,s Leucaena, Desmanthus* (grazed)	Considered clean. Occasional future checks for new plants.
30.07.14	Kookaburra	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Local control. Glyphoaste at label rates. Yes. Yes.	Inspection on site.	2	100 0	0 100		Few			0	Heavily frosted plants. Heavily grazed and droughted.	Not specified	Future checks for establishment and control of any new plants.
xx.11.11	Glenbower House	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit information only No		1	100		1	0	0	0	0	Areas recently sown to cotton	Cultivated (none)	Return visit after rainfall
xx.11.11	Glenbower Dam	1. Inspection of site 2. Treatment of plants 3. Discussion with manager 4. Demonstration of practices	Foot survey Not required Visit information only No		1.5	100		1	0	0	0	0	Very wet after 50 mm rain. Previously traeted areas all dead due to glyphosate added to tank.	*Species not provided.* Good grass cover in surrounds (4-5000kg/ha). Lots of Vigna trilobata	Revist Jan-Feb

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
xx.11.11	Kindon	1. Inspection of site	Foot survey		1.5	100		0.5	0	0	1	0		Good grass cover in surrounds (3-4000kg/ha).	Revist Jan-Feb
		2. Treatment of plants	Sprayed with Starane and D394Glyphosate at label rates + Graslan pellets	<5L		100								Some Marc desmanthus	
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.11.11	Boongargil (Toobeah)	1. Inspection of site	Unable to visit due to wet conditions		NA			0.5	?	?	?	?	Site regularly cultivated		Revisit when dry
		2. Treatment of plants	Cultivation			0	100								
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	no												
xx.11.11	Sunset Downs (Tara)	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Clean site	Quite dry, grass 4-5000 kg/ha, some capeela glycine marc desmanthus	Revist Jan-Feb
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	no												
xx.11.11	Belcrest (Wandoan)	1. Inspection of site	Foot survey		3.5	100		0.01	3	0	15	0		Quite dry, grass 1500-3000 kg/ha, Quite a few Stylo 110361, Capella glycine and Marc desmanthus	Revist Jan-Feb
		2. Treatment of plants	Sprayed with Starane Glyphosate mixture and dropped Graslan	<5L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.11.11	Narayen: 92-93 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0		Area grazed down; 2-3000 kg/ha	Revist Jan-Feb
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
xx.11.11	Narayen: 93-94 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	1	0			Area grazed down, 2-3000 kg/ha	Revist Jan-Feb
		2. Treatment of plants	Sprayed with Starane Glyphosate mixture and dropped Graslan	<5L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.11.11	Narayen 94-95 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	1	0		Area grazed down, 2-3000 kg/ha	Revist Jan-Feb
		2. Treatment of plants	Sprayed with Starane Glyphosate mixture and dropped Graslan	<5L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.11.11	Narayen Grazing Trial	1. Inspection of site	Foot survey and driving		1	100		8	~100?	?	?	0	4 of 5 paddocks slashed. Manager will complete slashing. IS in all paddocks, but numbers low.	Not described	Revist Jan-Feb
		2. Treatment of plants	Slashing	NA		0	100								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
xx.03.12	Glenbower Dam	1. Inspection of site	Foot survey		1	100		1	0	0	0	0	No plants found. Previously treated patches under good control.	*Species not provided.* Good grass cover (6-8000kg/ha). Lots of Vigna trilobata and glycine	Return mid-year
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												
xx.03.12	Glenbower House	1. Inspection of site	Foot survey		3	100		1	104	0	0	0	Cotton crop 1 m high	Cotton crop	Return mid-year
		2. Treatment of plants	Hand pulled seedlings after cultivation			50	50								
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
xx.03.12	Kindon	1. Inspection of site	Foot survey		1.5	100		0.5	0	0	2	0	Noel Cook has agreed to clear lime bushes and cultivate along rest of paddock, likely winter for wheat.	Mostly buffel. Good grass cover in surrounds (2-4000kg/ha). Some Marc desmanthus	Revisit mid-year
		2. Treatment of plants	Sprayed with Starane Glyphosate mixture and dropped Graslan	<5L		50	50								
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.03.12	Boongargil (Toobeah)	1. Inspection of site	Not completed.		NA			0.5	?	?	?	?	Site cultivated and vigorous cotton crop.	Not visited, cotton crop 1.5m high and very dense	Revisit mid-year
		2. Treatment of plants	Cultivation and cropping			0	100								
		3. Discussion with manager	Yes. Advised cotton crop vigorous.												
		4. Demonstration of practices	No												
xx.03.12	Sunset Downs (Tara)	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Some dead patches due to water logging. Graslan areas dead.	Mostly bluegrass. Desmanthus plentiful. Quite dry, grass 4-5000 kg/ha, some capella glycine	Revisit mid-year
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.03.12	Belcrest (Wandoan)	1. Inspection of site	Foot survey		3.5	100		0.01	16	0	0	0		Mostly buffel and setaria, grazed. Quite dry, grass 2-4000 kg/ha, Quite a few Stylo 110361, Capella glycine and Marc desmanthus	Revisit mid-year
		2. Treatment of plants	Sprayed with Starane Glyphosate mixture and dropped Graslan	<5L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.03.12	Narayen: 92-93 sowing	1. Inspection of site	Foot survey		2	100		0.01	3	0	0	0		Buffel, Rhodes and setaria grasses. Area grazed; 4-5000kg/ha	Revisit mid-year
		2. Treatment of plants	Sprayed with Starane Glyphosate mixture and dropped Graslan	<5L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
xx.03.12	Narayen: 93-94 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0		Buffel, Rhodes and setaria grasses. Area grazed; 4-5000kg/ha	Revisit mid-year
		2. Treatment of plants	Not required	<5L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												
xx.03.12	Narayen 94-95 sowing	1. Inspection of site	Foot survey		2	100		0.01	3	0	1	0		Buffel, Rhodes and setaria grasses. Area grazed; 4-5000kg/ha	Revisit mid-year
		2. Treatment of plants	Sprayed with Starane Glyphosate mixture and dropped Graslan	<5L		100									
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	No												
xx.03.12	Narayen Grazing Trial	1. Inspection of site	Foot survey and driving		2	100		8	~100?	?	?	0	Area slashed, but many plants reshooting. Discussed with manager, hopes to do next week	Mostly green panic, growing. 3-4000 kg/ha.	Revisit mid-year
		2. Treatment of plants	Slashing	NA			100								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
xx.03.13	Glenbower House	1. Inspection of site	Foot survey		1	100		1	0	0	0	0	Good grass cover (5-6000 kg/ha). Pigs rooting around in the area.	Sorghum crop	Return visit in a few months
		2. Treatment of plants	Not required				100								
		3. Discussion with manager	Yes - happy to take responsibility												
		4. Demonstration of practices	No												
xx.03.13	Glenbower Dam	1. Inspection of site	Foot survey		1.5	100		1	0	0	0	0	Very wet after 50 mm rain. Previously traeted areas all dead due to glyphosate added to tank.	Setaria, glycine, paspalum. Good grass cover in surrounds (6-8000kg/ha). Lots of *Vigna trilobata*	Return visit in a few months
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes - happy to take responsibility												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
xx.03.13	Kindon	1. Inspection of site	Foot survey		1.5	100		0.5	0	0	0	0	Wet after recent rain.	Light grass cover in surrounds (1-2000kg/ha). Mostly buffel. Some Marc desmanthus	Return visit in a few months
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Yes - happy to take responsibility												
		4. Demonstration of practices	NA												
xx.03.13	Boongargil (Toobeah)	1. Inspection of site	Unable to visit due to wet conditions		NA	90	10	0.5	686	0	0	0	Good rain in January. Area covered in pigeon pea.	Some capella glycine marc desmanthus	Return visit in a few months
		2. Treatment of plants	Cultivation and plants pulled			10	90								
		3. Discussion with manager	Demonstration and discussion about taking over control.												
		4. Demonstration of practices	no												
xx.03.13	Sunset Downs (Tara)	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Good moisture	Desmanthus and Macatr.	Return visit in a few months
		2. Treatment of plants	Not required				100 future								
		3. Discussion with manager	Demonstration and discussion about taking over control.												
		4. Demonstration of practices	NA												
xx.03.13	Belcrest (Wandoan)	1. Inspection of site	Foot survey		2	100		0.01	4	0	0	0	Good January rainfall.	Quite dry, grass 1500-3000 kg/ha, Mostly bluegrass. Quite a few Stylo 110361 and 110372 and Marc desmanthus	Return visit in a few months
		2. Treatment of plants	Sprayed with Glyphosate and dropped Graslan	<1 L		100									
		3. Discussion with manager	Visit information only (owner not available)												
		4. Demonstration of practices	no												
xx.03.13	Narayen: 92-93 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Good rain since January.	2-3000 kg/ha. Mostly bluegrass, buffel and panicum.	Return visit in a few months
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Yes. Discussion with Phil Fraser (only person on station).												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
xx.03.13	Narayen: 93-94 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Good rain since January.	2-3000 kg/ha. Mostly bluegrass, buffel and panicum.	Return visit in a few months
		2. Treatment of plants	Not required			100									
		3. Discussion with manager	Yes. Discussion with Phil Fraser (only person on station).												
		4. Demonstration of practices	NA												
xx.03.13	Narayen 94-95 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	3	0	Good rain since January.	2-3000 kg/ha. Mostly bluegrass, buffel and panicum.	Return visit in a few months
		2. Treatment of plants	Sprayed with Glyphosate and dropped Graslan	<0.5 L		100									
		3. Discussion with manager	Yes. Discussion with Phil Fraser (only person on station).												
		4. Demonstration of practices	Yes												
xx.03.13	Narayen Grazing Trial	1. Inspection of site	Foot survey and driving		1	100		8	difficult to estimate	?	?	0	Under grazing, but more cattle required to graze down. Difficult to detect plants.	4-5000 kg/ha	Return visit in a few months
		2. Treatment of plants	Slashing	NA		50	50								
		3. Discussion with manager	Yes. Discussion with Phil Fraser (only person on station).												
		4. Demonstration of practices	No												
XX.06.13	Glenbower House	1. Inspection of site	Foot survey		1	100		1	0	0	0	0	Good grass cover (5-6000 kg/ha). Pigs rooting around in the area.	Sorghum crop	Revist Jan-Feb
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
XX.06.13	Glenbower Dam	1. Inspection of site	Foot survey		1.5	100		1	0	0	0	0	Site rooted up by pigs. Very wet.	See above. Grass yiels 5-6000 kg/ha.	Revist Jan-Feb
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
XX.06.13	Kindon	1. Inspection of site	Foot survey		1.5	100		0.5	0	0	0	0	Subsoil moisture present. Told owner he could plough the whole area.	Grass cover < 1000 kg/ha.	Revist Jan-Feb
		2. Treatment of plants	Not required				100								
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												
XX.06.13	Boongargil (Toobeah)	1. Inspection of site	Unable to visit due to wet conditions		NA	100		0.5	0	0	0	0	Good subsoil moisture (nearby wheat emerging).	No detail	Revist Jan-Feb
		2. Treatment of plants	Cultivation and broadscale application of glyphosate.				100								
		3. Discussion with manager	Discussed previous visit												
		4. Demonstration of practices	NA												
XX.06.13	Sunset Downs (Tara)	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Sub-surface moisture	1-2000 kg/ha,	Revist Jan-Feb
		2. Treatment of plants	Not required												
		3. Discussion with manager	Previous visit												
		4. Demonstration of practices	NA												
XX.06.13	Belcrest (Wandoan)	1. Inspection of site	Foot survey		3.5	100		0.01	0	0	0	0		1-2000 kg/ha.	Revist Jan-Feb
		2. Treatment of plants	Not required												
		3. Discussion with manager	Discussed off-site. Owner happy to assume control.												
		4. Demonstration of practices	NA												
XX.06.13	Narayen: 92-93 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Dry and grass well-grazed.	1-2000 kg/ha	Revist Jan-Feb
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
XX.06.13	Narayen: 93-94 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Dry and grass well-grazed.	1-2000 kg/ha	Revist Jan-Feb
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
XX.06.13	Narayen 94-95 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0	Dry and grass well-grazed.	1-2000 kg/ha	Revist Jan-Feb
		2. Treatment of plants	Not required			50	50								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	No												
XX.06.13	Narayen Grazing Trial	1. Inspection of site	Foot survey and driving		1	100		8	Unknown. In patches.	?	?	0	Quite dry. Well but patchily grazed. Indigofera top-grazed so may be spread in dung. Cattle confined to the paddock.	Not described	Revist Jan-Feb
		2. Treatment of plants	Slashing	NA		50	50								
		3. Discussion with manager	Yes. Manager plans to undertake spot-spraying.												
		4. Demonstration of practices	Yes												
XX.12.13	Glenbower House	1. Inspection of site	Foot survey		1	100		1	0	0	0	0	Area cultivated ready for nexy crop	Sorghum crop	Revist Jan-Feb
		2. Treatment of plants	Not required				100								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
XX.12.13	Glenbower Dam	1. Inspection of site	Foot survey		1	100		1	0	0	0	0		3-6000 kg/ha	Revisit before June 2014
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
XX.12.13	Kindon	1. Inspection of site	Foot survey		1	100		0.5	0	0	0	0		Light grass cover (~1000 kg/ha). Some Marc desmanthus.	Revisit before June 2014
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only												
		4. Demonstration of practices	NA												
XX.12.13	Boongargil (Toobeah)	1. Inspection of site	Unable to visit due to wet conditions		NA	100		0.5	0	0	0	0	Pigeon pea crop recently planted on mounds with 30 cm furrows.		Revisit before June 2014
		2. Treatment of plants	Cultivation and broadscale application of glyphosate.				100								
		3. Discussion with manager	Discussed previous visit												
		4. Demonstration of practices	NA												
XX.12.13	Sunset Downs (Tara)	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0		Grass cover <1000 kg/ha	Revisit before June 2014
		2. Treatment of plants	Not required												
		3. Discussion with manager	Previous visit												
		4. Demonstration of practices	NA												
XX.12.13	Belcrest (Wandoan)	1. Inspection of site	Foot survey		3	100		0.01	0	0	0	0		1-2000 kg/ha.	Revisit before June 2014
		2. Treatment of plants	Not required												
		3. Discussion with manager	Discussed off-site. Owner happy to assume control.												
		4. Demonstration of practices	NA												
XX.12.13	Narayen: 92-93 sowing	1. Inspection of site	Foot survey		1	100		0.01	0	0	0	0		1-2000 kg/ha	Revisit before June 2014
		2. Treatment of plants	Not required			50	50								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
XX.12.13	Narayen: 93-94 sowing	1. Inspection of site	Foot survey		1	100		0.01	0	0	0	0		Grass < 1000 kg/ha	Revisit before June 2014
		2. Treatment of plants	Not required			50	50								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
XX.12.13	Narayen 94-95 sowing	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0		1-2000 kg/ha.	Revisit before June 2014
		2. Treatment of plants	Not required			50	50								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
XX.12.13	Narayen Grazing Trial	1. Inspection of site	Foot survey and driving		1	100		8	??	Many	?	0	Manager leaving, so will need to speak to new manager.	<1000 kg/ha	Revisit before June 2014
		2. Treatment of plants	Slashing	NA		50	50								
		3. Discussion with manager	Yes. Manager plans to undertake spot-spraying.												
		4. Demonstration of practices	No												
XX.04.14	Glenbower House	1. Inspection of site	Foot survey		1	100		1	200	0	0	0	Farmer started cultivating the area during visit. Both sites shown to local council pest manager. Burst of seedlings following rain.	Sorghum crop	None
		2. Treatment of plants	Not required				100								
		3. Discussion with manager	Yes	Met with Gary Turner (Toowoomba Regional Council).											
		4. Demonstration of practices	No	Yes. To Gary Turner.											
XX.04.14	Glenbower Dam	1. Inspection of site	Foot survey		1	100		1	0	0	0	0	Left Graslan with owner. Good recent rainfall	5-6000 kg/ha Glycine and desmanthus throughout.	Site likely clean. Revisit after significant rainfall.
		2. Treatment of plants	Not required												
		3. Discussion with manager	Yes	Met with Gary Turner (Toowoomba Regional Council).											
		4. Demonstration of practices	No	Yes. To Gary Turner.											

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
XX.04.14	Kindon	1. Inspection of site	Foot survey		1	100		0.5	0	0	0	0		Light grass cover (~2000 kg/ha). Some Marc desmanthus.	Revisit before June 2014
		2. Treatment of plants	Not required												
		3. Discussion with manager	Visit information only	Met with Nathan Stephenson (Goondiwindi Regional Council).											
		4. Demonstration of practices	Yes	Yes. To Nathan Stephenson.											
XX.04.14	Boongargil (Toobeah)	1. Inspection of site	Unable to visit due to wet conditions		NA	100		0.5	0	0	0	0	Site not visited as farmer had just ploughed the area the previous week. Good rain prior to cultivation.	Buffel with desmanthus.	None. Council assumed responsibility.
		2. Treatment of plants	Cultivation and broadscale application of glyphosate.				100								
		3. Discussion with manager	Discussed over the phone.	Met with Nathan Stephenson (Goondiwindi Regional Council).											
		4. Demonstration of practices	NA	Yes. To Nathan Stephenson.											
XX.04.14	Sunset Downs (Tara)	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0		Grass cover 4-5000 kg/ha. Mostly bluegrass with desmanthus, Capella and atro.	None
		2. Treatment of plants	Not required	Left Graslan with owner.		50	50								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												
XX.04.14	Belcrest (Wandoan)	1. Inspection of site	Foot survey		2	100		0.01	0	0	0	0		2000 kg/ha. Lots of desmanthus and seabrana stylo.	None
		2. Treatment of plants	Not required												
		3. Discussion with manager	Discussed off-site. Owner happy to assume control.												
		4. Demonstration of practices	NA												
XX.04.14	Narayen: 92-93 sowing	1. Inspection of site	Foot survey		1	100		0.01	0	0	0	0		3-5000 kg/ha	None
		2. Treatment of plants	Not required			50	50								
		3. Discussion with manager	Yes												
		4. Demonstration of practices	NA												

Date	Location	Activities completed	Methods	Herbicide applied (total mixed product)	Officer work time (hrs)	Work time (%)		Area containing plants (ha)	No. of first year plants	No. of older plants	No. of regrowing plants[1]	Seeding plants (%)	Comments	Companion species	Actions required
						Project	Local								
XX.04.14	Narayen: 93-94 sowing	1. Inspection of site	Foot survey		1	100		0.01	0	0	0	0		Grass 1500-2500 kg/ha	None
		2. Treatment of plants	Not required			50	50								
		3. Discussion with manager	Yes. New Manager (Don Cherry) from Emerald Pastoral College.												
		4. Demonstration of practices	Yes.												
XX.04.14	Narayen 94-95 sowing	1. Inspection of site	Foot survey		1	100		0.01	0	0	0	0		<1000 kg/ha.	None
		2. Treatment of plants	Yes. New Manager (Don Cherry) from Emerald Pastoral College.			50	50								
		3. Discussion with manager	Yes.												
		4. Demonstration of practices	No												
XX.04.14	Narayen Grazing Trial	1. Inspection of site	Foot survey and driving		1			8	Many	?	?	?	Spoke with new manager, viewed grazing trial site and sent info sheets.	<1000 kg/ha	Revisit before June 2014
		2. Treatment of plants	Slashing	NA		50	50								
		3. Discussion with manager	Yes. New Manager (Don Cherry) from Emerald Pastoral College.												
		4. Demonstration of practices	Yes.												
**.08.13	Bluff Downs	1. Inspection of site	No			0	0	0.5	?	?	?	?	A few plants may be present.		Try to visit by end of project.
		2. Treatment of plants	No			0	0								
		3. Discussion with manager	Phone call.	Chris told not to bother coming.											
		4. Demonstration of practices	No												