MEAT & LIVESTOCK
AUSTRALIA

On farm

Managing Old (discontinued) Plant Evaluation Sites (MOPES)

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Environment

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Abstract

Over one hundred discontinued plant evaluation sites throughout Queensland were thoroughly monitored with the information converted to database. Four priority legume “target” plants (*Acacia angustissima/boliviana, Indigofera schimperi, Aeschynomene paniculate, Aeschynomene brasiliana*) were nominated after consultation with many stakeholders. These target plants are being contained and eradicated using 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 over the three years, total eradication of legume target plants has not yet been achieved where soil seed reserves have accumulated due to past seeding events. Twenty sites remain as priority for treatment and on-going monitoring while forty five sites are listed as currently clean. However some of these forty five, plus the remaining sites, require periodic to annual monitoring for seedlings. It is recommended that monitoring and control of target plants be continued for a further three or more years to complete the task started by the Managing Old (discontinued) Plant Evaluation Sites project.

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.

1. Background

Pasture development, using introduced grasses and legumes, has contributed significantly to increased beef production and herd management in northern Australia (Walker and Weston 1990, Chudleigh and Bramwell, 1996, Walker et *al*., 1997). Introduced pasture development has also encouraged and benefited land management practices. Selected species, or mixes of species can reduce soil erosion, improve quality of run-off water, stabilise waterways and gullies, compete with broad leaf weeds and increase viability and sustainability of many grazing system enterprises. Due to their higher carrying capacity and resilience after grazing, sown pastures can allow native pastures to be strategically rested.

However, while colonising ability and high yields associated with the capacity to dominate vegetation are important characteristics of introduced pasture cultivars, these characteristics have also lead to some forage plant cultivars being labelled as environmental weeds (McIvor and McIntyre 1997). Chudlleigh and Bramwell (1996) assessed both the positive and negative impacts of introduced tropical pasture plants in northern Australia and suggest that, rather than attempt to apportion responsibility for past introductions of introduced plants, we look to the future to ensure that undesirable plant introductions are minimised or do not occur at all.

With funding from Australia's National Weeds Program the Australian Quarantine Inspection Service (AQIS) Weed Risk Assessment (WRA) system (proclaimed in 1998) is used to make decisions on plant imports. AQIS rejected 17% of species proposed for import between 1997 to 1999, using their WRA system (Virtue, 1999). Also using the WRAS, AQIS has initiated a process to assess the weediness of species held in the various genetic resource centres (GRC's) in Australia. This has identified a number of species that should not be released for evaluation. However, AQIS' power under the Quarantine Act (1908) does not extend to controlling release from GRC's of species already in the country. This relies heavily on cooperation from research agencies, and the development of voluntary control systems.

Project objectives

In today's social climate of increasing environmental awareness, rural industries and research agencies need to be, and be seen to be, environmentally responsible. We need to be mindful of shifts in community perceptions and pending changes to legislation relating to fodder plant introduction and evaluation processes.

This project aimed to monitor and manage old, discontinued plant evaluation sites for introduced forage plants that may have the potential to become environmental weeds. A pre-cautionary containment and eradication plan was developed and implemented for accessions so identified.

Ongoing management of old, discontinued plant evaluation sites on private land is necessary where the landowner requests certain plants be eradicated and where the evaluators perceive a potential weed risk from "promising" but unreleased accessions. The risk is greatest where introduced plants are well adapted to climate and soils but demonstrate low palatability to stock. Other contributing attributes could include early/heavy seed set, strong regeneration from seed/seedlings (invasiveness) and stickiness of seed pods, stems or leaves. For this project such plants are referred to as "Target Plants".

Regardless of palatability, well adapted grazing plants may also impact on other forms of land use including roadsides, reserves, farming operations. Tolerance and susceptibility to herbicides should be established for all forage plants prior to release, and is now included in forage plant evaluation programs (Clem and Jones, 1998, Bishop and Cook, 1998). These herbicide screening studies are presented in the final reports of projects Legumes for Clay Soils, (Clem, in press) and Back-up Legumes for Stylos (Bishop, in press).

All evaluation sites are to be left in a tidy and useable condition for the landowner by removing pegs, fences and where required restore the site to its original condition. Where target plants were present some form of permanent marker should remain, or GIS position data recorded.

Industry consultation

Landholders with evaluation sites have been consulted throughout the life of this project. As evaluation projects approach completion landholders have been consulted on future management of sites. Some have requested elimination of less palatable unreleased species while others ask that pegs and fences be removed to allow alternative use of the sites. Some ask that the sites remain for future evaluation and monitoring.

At all sites where “spray out” of less palatable species has been initiated, landholders have been consulted on management arrangements. Agribusiness and R,D&E agency interests have been consulted during annual North Australian Pasture Plant Evaluation Committee (NAPPEC) and Herbage Plant Liaison Committee (HPLC) meetings.

Development of this project was initiated and discussed at the MLA NAP Annual Peer Review workshop “Sown pasture species development projects” held at Yeerongpilly in July 1998 (Bishop and Hopkinson 1998).

A cost-benefit justification for this project is in appendix 10.1 with much of the information drawn from Cheedleigh and Bramwell 1996 report.

A history of fodder plant evaluation in Queensland prepared by Bruce Cook, DPI Gympie, appears as appendix 10.2.

2. Project objectives

2.1. To compile a register of forage plant evaluation sites established by DPI and CSIRO in Queensland since 1986. Known earlier sites where target plants were sown will also be monitored.

2.2 To develop and implement a management plan for discontinued evaluation sites.

2.3 To monitor, contain and, if possible, eradicate currently identified, and potential of concern and “target”, introduced forage plants.

2.4 To record procedures and document results, for development of a site management manual.

3. Methodology

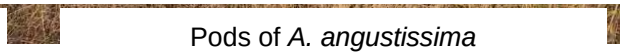
The QPASTURES database was used to compile a list of evaluation sites established by DPI and CSIRO between 1986 and the present. Forage plants sown at each site were listed and sites with target plants noted. This procedure has also allowed a check and update of the QPASTURES records.

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.

"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, prolific seeder, seedling establishment and spread.

A. angustissima shrub



Pods of *A. angustissima*

Inflorescence and foliage of *A. angustissima*

Indigofera schimperi:
Well adapted to sub-humid zone, low palatability (1 out of 3, although leaf is browsed in sub-humid zones), a grazing trial at Brian Pastures Research Station became legume dominant in 3rd year and cattle lost weight (Bob Clem, unpublished data), suckering from roots when disturbed, prolific seeder, seedling establishment and spread.

Indigofera schimperi plant

Aeschynomene paniculata:
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. On inspection of a grazing evaluation trial at the NT DPI&F Coastal Plains Research Station near Darwin in 1994, the North Australia Pasture Plant Evaluation Committee observed that cattle were not grazing the *A. paniculata* and, although there was a liveweight gain benefit, recommended that *A. paniculate* not be released as a cultivar.

Aeschynomene brasiliana:
Well adapter to sub-humid zone (second to Seca stylo in BULS project), leaves stems and pods sometimes sticky, moderate palatability (2 out of 3) but no live weight gain (LWG) data available due to drought at BULS project grazing evaluation site at Mt Garnet (1992-95). CPI 92519 was placed on pre-release with Queensland Herbage Plant Liaison Committee in 1990 but the 1996 QHPLC meeting removed it from pre-release, on the basis of reports of low palatability at some sites and absence of LWG data, and recommended to BULS project leader that it be eradicated from existing sites.

Sites monitored

Sites targeted are those associated with projects funded by the MRC/MLA NAP Programs, including:

Coordinated Plant Evaluation (COPE) (COPE 1 1987-90, COPE 2 1991-95) (Final Report of MRC Projects CS054/185 and DAQ053/081; Project Leaders Bruce Pengelly, CSIRO and Ian Staples, QDPI, printed April 10, 1996).

- 15 Project sites, through out coastal/sub-coastal Queensland
- 2000 accessions (approx.) sown
- 16 accessions targeted *(Aeschynomene brasiliana* 10, *Aeschynomene paniculata* 2, *Indigofera schimperi* 4).

Browsnet

- 7 sites
- 51 accessions
- 8 target accessions (*Acacia angustissima/bolivia).*

Legumes for Clay Soils (LCS) (1993-98) (Interim Final Report on MLA Project DAQ.086, Project Leaders RL Clem, QDPI and RM Jones, CSIRO, printed 1996).

- 24 Project sites targeting clay soils in CQ and SQ
- 145 legume accessions sown
- 4 accessions targeted (*Indigofera schimperi*), 4 Res. Stn. Sites and 14 property sites.

Back-up Legumes for Stylos (BULS) (1992-98) (Interim Final Report on MLA Project DAQ.083, Project Leader Harry Bishop, QDPI, printed October 1996).

- 18 Project sites throughout coastal and sub-coastal Qld and Top End of NT (2 sites).
- 56 legume accessions sown
- 3 accessions targeted (*Aeschynomene brasiliana* 2, *A. paniculata* 1).

CSIRO Shrub Legumes under grazing (CS187, 1992-98) (Palmer, 1998) Evaluation of selected legumes under cattle grazing. MLA NAP Annual peer review of Sown Pasture species development and legume dominance and soil acidification projects, pp 41-48

- 3 sites
- 4 species including *Acacia boliviana* (Rockhampton) and *Calliandra calothyrsus.*

Total number of official sites 67

Adaptation/observation sites (supporting official sites).

- North and north west Queensland 15 sites, Target accessions *A. brasiliana, A. paniculata, I. schimperi, Acacia angustissima.*
- Central and central west Queensland 15 sites Target accessions (as above)
- South east and south west Queensland 15 sites Target accessions (as above)

Total supporting sites 45 (many will not have target plants but need initial monitoring).

Site management

Each site was surveyed for potential “target” forage plants. Where identified, document area and spread, inside and outside original site. Discuss results of survey with property owner/manager.

Contain and eliminate target plants using recommended herbicide spray-out and management procedures applicable to the site (de-stocking, fire, over-sowing with adapted grass cultivar or locally naturalised grass, fertilising with nitrogen, buffer zones). Table 1 shows the herbicide treatments used for spray-out of target plants.

Discuss grazing management with landholder/manager (summer spelling to encourage companion grass competition, autumn spelling to avoid seed dispersal via animal. Record results of landholder herbicide and management practices. Develop, refine and document effective procedures. Archive outcomes in QPASTURES database.

4. Results and discussions

Qpastures

The QPASTURES database has been upgraded to a Y2K compatible system and has been available to all DPI staff on the intranet since January 2001. Thus officers can search themselves for additional information about old sowings as well as add short reports about visits to suspect sites. Such reports would consist of a record in the Trial Site Comment file about recent management and seasonal conditions plus entries in the Performance Details file about the persistence, spread and spray tolerance of individual accessions still present. Where an accession's identity is unequivocal, extra details can be provided about the size and yield of persisting accessions plus observations on pests and diseases and palatability to livestock.

QPASTURES provides summaries about most forage plant evaluation work conducted in Queensland. It has been on the DPI computer network since 1988 and is steadily expanding its content. With the restructuring of QDPI plus a shift in program focus, new staff often lack knowledge of potential pasture species and their weedy relatives. QPASTURES will therefore be a basic resource on pasture plant knowledge in future. Any group or person wanting quick access to existing information, published and unpublished, about released or unreleased pasture or browse plants, for any purpose, is catered for. Such plants may also have potential for rehabilitation works, amenity plantings or further research.

The MOPES project has allowed the QPASTURES database to continue to expand and evolve to meet the information needs of a wide variety of people, - researchers, teachers, students, extension officers, weed management programs, policy makers, librarians, primary producers, consultants etc. If QPASTURES is not continued we would be seriously undervaluing research done over the past 50 years. Such research investment from many primary industries runs into tens of millions of dollars with a long term payback period of decades or even over 100 years for perennial pastures.

Regions

North Queensland Seasonally Dry Tropics

(Coordinator RW Walker, DPI Walkamin Research Station. The NQ full report is in Appendix 10.3)

Sixteen discontinued pasture plant evaluation sites in which "target" species were sown were identified from the QPASTURES database. Details are shown in Table 2.

Of the 16 sites, nine are clean with no further action required apart from periodic monitoring, as resources permit. Three sites (Batavia Downs, Sugarbag and Burlington) need annual monitoring for seedlings and treatment (as required), while the remaining four sites require priority monitoring and treatment (priority for available resources).

The **Batavia Downs** site in Cape York Peninsula is high priority for containment and eradication of *Aeschynomene paniculata* which has spread from original plots, albeit as isolated plants in some areas of the property. Through normal closure of the peninsula road during the wet season project staff have been unable to reach the site for early "wet season" application of Grazon DS herbicide. Spraying of more mature plants after the "wet" has only been partially effective.

In the original fenced plot area sown to Indian bluegrass (*Bothriochloa pertusa* cv. Keppel) and growing with naturalised cassia and calopo legumes, strong competition is containing the *A. paniculata*. Burning and over-sowing colonised areas with the late flowering Keppel Indian bluegrass after the first storms is considered a worthwhile option to greatly reduce seedling establishment. Although Graslan gives good control of *A. paniculata,* its general use is not recommended in this open woodland country.

There is no sign of grazing on *A. paniculata* at Batavia Downs and the plant obviously has low palatability. However Batavia Downs runs few cattle. In the Mackay region "top grazing" of this plant has been observed. The future uncertainty of tenure over Batavia Downs plus it's isolation puts a high priority on the eradication of this plant at this site because of its possible future weed potential.

Sugarbag: At this 40 ha site the general consensus concludes there is little likelihood of totally eradicating the *Aeschynomene brasiliana* (large area, high soil seed reserves, situated in non-arable open woodland country). The focus is on containment, reducing its frequency by spraying dense stands and introducing/over-sowing a competitive grass such as Keppel bluegrass sown through a "Crocodile Seeder". The owner of 'Sugarbag' says overall herbicide treatment is not an option as cattle graze this legume well and it is in an important weaner paddock containing other sown legume cultivars such as stylo and cassia.

Burlington (Mt Garnet): Further germination of *Aeschynomene brasiliana* was recorded this year and sprayed with Grazon DS. Good control was achieved. Parts of the site were cleared in late 2001 to allow for easier access to spraying. Frequency of *Aeschynomene brasiliana* 92519 (seedlings) recorded this year was 36 percent and plants were well grazed. No flowering or seeding evident. Indian couch is spreading into the area. The property owner originally requested that this plant be eradicated so monitoring and spraying as necessary needs to continue.

Lamonds Lagoon: Only a few seedlings of *Aeschynomene brasiliana* present. The paddock was heavily grazed. Plants sprayed with Grazon DS. This site is not of major concern but should continue to be monitored and treated as necessary.

Walkamin RS: A multitude of introduced pasture plants has been sown at this station since 1960, predominantly for seed to support sown pasture research throughout Queensland. The target genera for eradication within this project is *Acacia,* but any other potential target plants encountered on non-arable land are treated as a matter of course.

Eradication of *Acacia* plants has been ongoing for a number of years and at present, is well in hand with ongoing monitoring and treatment as required.

Wrotham Park, Springmount: No target plants observed this year. These sites are now not of major concern, but should be monitored periodically.

Other sites need no further attention.

CSIRO NQ Sites

Chris Gardiner (Tropical Plant Sciences, School of Tropical Bioology, James Cook University, Townsville) and his students are eradicating *A. angustissima* from **Campus Creek** opposite CSIRO Davies Laboratory. He is supporting **CSIRO (Davies Lab and Lansdown Research Station**) in attempting to eradicate *Acacia angustissima* from both sites, plus an apparent 'feral' highway site near Helen's Hill south of Ingham. A list of 10 sites in Queensland, where the Queensland Herbarium has received specimens of *A angustissima* will be inspected over the next 12 months to ensure that these plants have been eradicated. Plants of *A. angustissima* collected by Mr. Gardiner in 2000 at a discontinued research plot at *"Rosebank"* DPI Research Station, Longreach have also been confirmed by the Queensland Herbarium as being *A. angustissima. C*ontrol measures are being undertaken at this site.

CSIRO is also in the process of eradicating leucaena from the highway where it passes through Lansdown Research Station.

Campus Creek: Soon after the wet season ended (May 2002), an officer from the NR&M Tropical Weeds Research Centre, Charters Towers, applied the herbicide "Access" (Triclopyr/picloram) and diesel as a basal spray (60:1) to all known *A. angustissima* plants in Campus Creek. Care was taken to ensure the spray covered the entire circumference of each stem arising from the

base of the shrub to a height of approximately 50 cm. (Figure 2 in appendix 10.4). Inspection in June 2002 indicates that the Access/diesel treatment has been effective. Ongoing monitoring, possibly for many years, of the Campus Creek infestation will be required as *A. angustissima* is long lived, a prolific seeder and is hardseeded which would suggest that a substantial soil seed bank is likely to exist.
Chris Gardiner's full report plus a literature review of *A. angustissima* by students S. Mangru and C. Ramsay is in appendix 10.4.

Central Queensland

(Coordinator Terry Hilder, DPI, Mackay. The CQ full report is in Appendix 10.5)

Twenty-five sites where target plants were sown are being monitored, as shown in **table 3**. Priority sites are Tedlands (*A. paniculate)*, Glensfield (*A. paniculate* and *A. brasiliana*), Swans Lagoon (*A. brasiliana*), Googanga (*A. paniculate* and *A. brasiliana*), Oxford Downs (*I. schimperi*), Rolfe Park (*I. schimperi*), and Gallaway Pains (*A. paniculate, A. brasiliana* and *I. schimperi*). Highest priority target plants are *A. paniculata* and *I. schimperi* which need to be sprayed twice per year, early and late summer. *Acacia* species at Rockhampton have been eradicated but continued monitoring for seedlings is required. *Acacia* species in Bowen area require priority monitoring and treatment after the next general rain as the past few drought years has made monitoring and spraying of seedlings difficult.

The difficulty of eradicating pasture legumes from evaluation plots/sites, once seed reserves have accumulated in the soil over a number of years, is highlighted in Table 4. Spray-out operations using herbicides commenced at these sites in 1994. Nine years later in 2002 and after up to 14 spray-out operations seedlings are still emerging, albeit in decreasing numbers. No seed set has occurred at these sites since 1994. At commencement of spraying in 1994 these legumes had frequencies of around 90% to 100%.

Swans Lagoon:
Following de-stocking of the evaluation site over the previous year, fire has been used for two connective years to stimulate breaking of hard-seeded legumes and removal of grass cover to allow spraying of newly germinated seedlings early in wet season. Extra seed of Bowen strain Indian bluegrass, which is naturalised in this area, was sown following burning along with an application of nitrogen as 100 kg/ha of urea. The site is now accumulating maximum grass growth to reduce seedling establishment.

All sites where *A. paniculata* has previously seeded are a priority for ongoing monitoring and spraying. At Tedlands the manager is cooperating with grazing management, to reduce risk of seed spread and by applying nitrogen fertiliser to promote grass growth to compete with seedlings.

The Bowen area sites are a priority for monitoring of *Acacia* species and *I.schimperi* as they have been drought affected for a number of years with less opportunity to find or spray seedlings.

Southern Queensland

(Bob Clem Gympie, Bruce Cook Gympie, Trevor Hall Roma and Richard Silcock Toowoomba. The SQ full report is in appendix 6).

For Southern Queensland the main target plants are *Indigofera schimperi* and *Acacia* species as shown in Table 5.

In the COPE sites both *Aeschynomene brasiliana* and *Indigofera schimperi* are targeted as well as *Acacia boliviana* at the Browsenet site. *Aeschynomene brasiliana* was sown in the BULS site and *Indigofera schimperi* at the LCS sites.

Control of legumes at the COPE sites (all on research stations, except Holyrood south of Roma) has progressed well. These are checked and treated regularly. At Brigalow Research Station old

areas are now cultivated and sown to crops. The main difficulty with these sites is the moderate to high soil seed levels resulting from up to 10 years of evaluation when test plants were allowed to seed. At some sites only a few plants established but in most instances they did produce seed at least in some seasons.

A.brasiliana at the BULS site is still present but is not particularly well adapted and does not regenerate in some years.

It is doubtful that any seedlings of the leucaena lines have established at Brian Pastures Research Station and treatment of old plants is continuing.

Control of *I.schimperi* at Holyrood and the Brigalow and Narayen Research Stations should require little further activity other than checking periodically for seedlings. However further measures are required at Emerald and Brian Pastures Research Station where either old plants are still present or soil seed levels are likely to be high.

At the 11 "on farm" sites success with the control of *I.schimperi* has varied. At five sites (*Bindaroo, Carramah, Ellenvale, Kapalee, Kiamanna*) removal of plants has apparently been successful and no plants have been observed now for some time. At four sites (*Birrong,Goondooroo, Grosmont,Mutation*) either no plants or only a small population of seedlings has been seen but at the two other sites (*Kookaburra, Rangeview*) populations are greater and soil seed levels are likely to be very high. At two sites there has been little spread from the plot areas because of spraying outside the plots to control plants and also because of strong competition from vigorous and well-adapted grasses. However at Rangeview (Theodore) on a downs soil *I.schimperi* has been dominant in the pasture and considerable effort is still needed at this site.

CSIRO evaluation sites (Coordinator Cam McDonald, Indooroopilly since retirement of Dr RM (Dick) Jones, with assistance from Richard Silcock, DPI Toowoomba).

Of the 26 sites listed in Table 6, two are the more recent LCS and BULS sites at Narayan Research Station while another two are the Davies Lab and Lansdown Research Station sites also mentioned in table 2 of the NQ CSIRO section. The remaining sites date back to the mid 1970's. *Indigoferi* is the target plant at most of the old CSIRO early evaluation sites. *Acacia* species are at three sites and *Aeschynomene brasiliana* at one site as shown in table 6. All these sites are situated in sub-humid areas and travel distance, drought and low staff numbers make regular site monitoring and treatment difficult.

All sites have been visited twice yearly since 1997. Plants have been sprayed with a mixture of Brushoff and Starane and, until 2000, Graslan.

The two plantings of *A. brasiliana* at Narayen are almost clean, with just a few seedlings appearing. No seeding has occurred for several years but site will still need to be monitored.

The LCS sites at Narayen are almost clean of *I. schimperi*. No plants were found at the last visit in May 2002, and no seeding has occurred for several years. The site will need to be monitored annually. The grazing trial area is under control. There was little growth and no seeding in 2002, however future monitoring and treatment will be required for a number of years.

The sites at Pittsworth, Kindon, Toobeah, Tara and Wandoan are almost clean of *I schimperi*. The sites have been visited twice a year with very few plants found on some visits and no seeding for several years. At visit in May 2002, 20-40 plants found at all sites except Toobeah. Biannual monitoring needs to continue until no plants are found.

Table 1. Herbicide treatment details

Site	Herbicide (/mixture)						
	Brushof 7.5 - 10 g/ha	Brushoff 7.5 - 10 g/ha+ Banvel 200, 750 ml/ha	Brushoff 7.5 - 10 g/ha + Starane 300ml/100L	Grazon DS (spray) 350 ml/100L	Access (basal bark) 60:1 with diesel	Graslan 1-2 g/m^2	Roundup 1ml/100ml + Banvel 200, 750ml/ha
Kookaburra		Ind sch					
Batavia Downs				Aes pan, Aes bra		Aes pan, Aes bra	
Burlington				Aes bra			
Lamond's Lagoon				Aes bra		Aes bra	
Walkamin R.S.				Aes bra, Aca ang			
Wrotham Park				Ind sch			
Campus Ck					Aca ang		
Brian Pastures R.S.	Aes bra, Ind sch				Aca ang		
Holyrood						Ind sch	Ind sch
Brigalow R.S.	Aes bra, Ind sch					Ind sch	
Mutation						Ind sch	
Oxford Downs		Ind sch					
Rolfe Park		Ind sch	Ind sch				
Glensfield		Aes pan, Aes bra					
Blue Mt.		Aes pan, Aes bra					
Swan's Lagoon R. S.		Aes pan, Aes bra	Aes pan, Aes bra				
Carmilla Glen		Aes pan, Aes bra					
Tedlands		Aes pan, Aes bra	Aes pan, Aes bra				
Granite Vale		Aes pan, Aes bra	Aes bra				
Sorrell Hills		Aes pan, Aes bra	Aes bra				
Wadeleigh		Aes pan, Aes bra	Aes bra				
Gallway Plains		Aes pan, Aes bra, Ind sch	Aes pan, Aes bra				
Emerald R.S.	Ind sch						
Kookaburra	Ind sch						
Kappalee	Ind sch						
Rangeview	Ind sch						
Birrong	Ind sch						
Goondooroo	Ind sch						
Bindaroo	Ind sch						
Carramah	Ind sch						

Target plant code:
Ind sch = Indigofera schimperi
Aca and = Acacia angustissima
Aes bra = Aeschynomene brasiliana
Aes pan = Aeschynomene paniculata

Registered proprietry names used
Brushoff = metsulfuron methyl
Banvel 200 = dicamba
Starane 200 = fluoxypyr
Grazon DS = triclopyr 300g/L + picloram 100g/L
Access = triclopyr 240g/L + picloram 120g/L
Graslan = tebuthiruon
Roundup = glyphosate 360g/L

Table 2. Details of DPI discontinued DPI pasture plant evaluation sites – North Queensland Region (assessed by Bob Walker, DPI Walkamin Research Station).

Site	Town	Project	Target species	Action	Last Visit
Batavia Downs	Weipa	Mba P38.7	*Aeschynomene brasiliana*	**Monitor, treat as required**	4 / 2002
Batavia Downs	Weipa	Mba P38.7	*Aeschynomene paniculata*	Priority manage/treat	5 / 2002
Sugarbag	Mt Garnet	Mba.Uncat.92	*Aeschynomene brasiliana*	Monitor, manage/treat	5 / 2002
Sugarbag	Mt Garnet	Mba Uncat 94	*Aeschynomene brasiliana*	Monitor, manage treat	6 / 2001
Burlington	Mt Surprise	Mba P38.4	*Aeschynomene brasiliana*	Priority treatment	6 / 2001
Lamonds Lagoon	Mt Garnet	Mba.Uncat.92	*Aeschynomene brasiliana*	Monitor, treat as required	5 / 2002
Wrotham Park	Chillagoe	BRP P218.9	*Indigofera schimperi*	Monitor, treat as required	7 / 2001
Walkamin R.S.	Walkamin	WRS P48.14	*Acacia angustissima*	Priority treatment	6 / 2001
Walkamin R.S.	Walkamin	WRS P48.14	*Acacia* sp.	Priority treatment	6 / 2001
Springmount	Mareeba	Mba P38.7	*Aeschynomene brasiliana*	Monitor, treat as required	7 / 2001
Double Lagoons	Normanton	Mba P38.7	*Aeschynomene brasiliana*	No further action required	5 / 2000
Lucky Downs	Greenvale	Mba P38.7	*Aeschynomene brasiliana*	No further action required	clean
Milgarra	Normanton	Mba Uncat 87	*Aeschynomene brasiliana*	No further action required	clean
Milgarra	Normanton	Mba Uncat 87	*Aeschynomene paniculata*	No further action required	clean
Mt Surprise	Mt Surprise	Mba Uncat 87	*Aeschynomene brasiliana*	No further action required	clean
Mt Surprise	Mt Surprise	Mba Uncat 87	*Aeschynomene paniculata*	No further action required	clean
Mt Webb	Cooktown	Mba P38.7	*Aeschynomene brasiliana*	No further action expected	clean
Southedge R.S.	Mareeba	Mba P39.13	*Acacia* sp.	No further action expected	clean
Southedge R.S.	Mareeba	Mba P39.1	*Aeschynomene brasiliana*	No further action expected	clean
Southedge R.S.	Mareeba	Mba P39.1	*Aeschynomene paniculata*	No further action expected	clean
Woodview	Normanton	Mba Uncat 87	*Aeschynomene paniculata*	No further action required	clean
Yaramulla	Mt Surprise	Mba P38.7	*Aeschynomene brasiliana*	No further action required	5 / 2000
Inverleigh	Normanton	BRP P218.9	***Indigofera schimperi***	No further action required	7 / 2001

Table 3. Details of DPI discontinued pasture plant evaluation sites – Central Queensland Region Summary (Assessed by Terry Hilder, DPI, Mackay).

Sites	Town	Project	Target Species	Action	Last Visit
Glensfield	Sarina	BULS	*Aeschynomene brasiliana*	Monitor/treat	4 / 2001
Granite Vale	St Lawrence	BULS	*A.brasiliana, A. paniculata*	Priority monitor/treat	4 / 2001
Wadeleigh/Bethome	Miriam Vale	BULS	*A. brasiliana*	Monitor/treat	4 / 2001
Swan's Lagoon R/S	Ayr	BULS	*A. brasiliana*	Priority monitor/treat	3 / 2001
Sorrell Hills	Duaringa	BULS	*A. brasiliana*	Monitor/treat	4 / 2001
Tedlands	Koumala	COPE & Leg Adptn	*A. brasiliana, A. paniculata*	Priority monitor/treat	4 / 2001
(Bob Fallis)	Sarina	Leg Adptn	*A. brasiliana, A.. paniculata*	Priority monitor/treat	4 / 2001
Oxford Downs	Nebo	LCS & Leg Adptn	*Indigofera schimperi*	Priority monitor/treat	12 / 2000
Lynford	Nebo	Adptn	*A. brasiliana*	Monitor	5 / 2001
Goorganga	Proserpine	Leg Adptn	*A. brasiliana, A. paniculata*	Priority inspect/monitor/treat	1999
Crediton	Eungella	Leg Adptn	*A. brasiliana*	Clean	-
Eungy	Nebo	Leg Adptn	*A. brasiliana, A. paniculata*	clean	10 / 89
(Glen Gough)	Proserpine	Leg Adptn	*A. brasiliana, A. paniculata*	Clean	-
Willunga	Nebo	BULS & COPE	*A. brasiliana, Indigofera schimperi*	Monitor (clean)	9 / 98
Carmila Glen	Carmila	Leg Adptn	*A. brasiliana*	Monitor	4 / 2001
Rolfe Park	Middlemount	LCS	*Indigofera schimperi*	Priority monitor/treat	12 / 2000
Gallaway Plains	Calliope	COPE	*A. brasiliana, A.paniculata* *B. Indigofera schimperi*	Priority inspect/treat	4 / 2001
Brigalow R/S	Theodore	ACIAR	*Leucaena* accessions/hybrids	Monitor, treat as required.	2001
Isladell	Raglan	Shrub Legumes	*Acacia boliviana*	Monitor (clean)	2000
Correct. Centre	Rockhampton	BROWSNET	*Acacia-Leucaena access/spp.*	Monitor and treat	2001
Parkhurst	Rockhampton	Plant Nursery	*Acacia* spp.	Monitor, treat as required.	12 / 2000
Havilah	Collinsville	Leg Adptn - Clays	*Indigofera schimperi*	Priority inspect	7/1999
Myuna	Collinsville	Leg Adptn - Clays	*Indigofera schimperi*	Priority monitor/treat	6 / 1999
Mt Danger	Bowen	Leg Adpt	*A. brasiliana, A. paniculata*	Continue monitoring	7 / 2000
Birralee	Collinsville	Leg Adptn - Clays	*A.brasiliana, A.paniculata, Acacia angustissima*	Priority monitor/treat	7 / 1999

Table 4. Effectivenes of spraying CQ target plants/plots.

Sites	Target Plants	No. of Sprayings	% Frequency of Plants/seedlings	
			Start	Finish
Glensfield (BULS)	*Aeschynomene brasiliana*	14	>90	<5
Granite Vale (BULS/Adaptn. Plots)	*Aeschynomene brasiliana*	11	80	3
Wadeleigh (BULS)	*Aeschynomene brasiliana*	7	>60	8
Swan's Lagoon (BULS)	*Aeschynomene brasiliana*	12	>90	30 (CPI 92519) or 3 (93592)
Sorrell Hills (BULS)	*Aeschynomene brasiliana*	6	>90	55
Tedlands (Adaptn. Plots)	*Aeschynomene brasiliana*	5	20	0
Bob Fallis (Adaptn. Plots)	*Aeschynomene brasiliana*	7	50	1
Glensfield (BULS)	*Aeschynomene paniculata*	14	10	0
Tedlands (Adaptn. Plots)	*Aeschynomene paniculata*	5	90	5 to10
Bob Fallis (Adaptn. Plots)	*Aeschynomene paniculata*	5	90	1
Oxford Downs (LCS)	*Indigofera schimperi*	4	Few present	Few present
Rolfe Park (LCS)	*Indigofera schimperi*	6	Few present	Few present
Gallaway Plains (COPE)	*Indigofera schimperi*	3	Few present	Few present

Table 5. Details of discontinued DPI pasture plant evaluation sites - Southern Queensland Region (Assessed by Bruce Cook, DPI Gympie; Bob Clem, DPI Brian Pastures Research Station; Richard Silcock, DPI Toowoomba and Trevor Hall, DPI Roma).T

Site	Town	Project	Target Species	Action	Last Visit
Narrabri	Gympie	BULS	*Aeschynomene brasiliana* CPI 92519, 93592	Present but no risk. Monitor periodically.	6 / 2000
Wolvi	Gympie	COPE	*Aeschynomene brasiliana* *A. paniculate* *Indigofera schimperi*	Target species not present. Monitor periodically.	6 / 2000
Holyrood	Roma	COPE	*Aeschynomene brasiliana* *Indigofera schimperi*	Monitor and treat *Indigofera*.	6 / 2001
Research Station	Roma	Browsnet	*Acacia* spp.	Monitor and treat.	6 / 2001
Brigalow R S	Theodore	COPE	*Aeschynomene brasilian* *Indigofera schimperi*	Not sited- clean Monitor and treat (#)	01/ 2002
Brian Pastures R S (Granite)	Gayndah	COPE	*Aeschynomene* *Indigofera*	Not sited- clean Monitor and treat.	01/2002
Brian Pastures R S (Basalt)	Gayndah	COPE	*Aeschynomene* *Indigofera*	Monitor and treat as required	06/2002
Brian Pastures R S	Gayndah	Browsnet	*Acacia* spp.	Monitor and treat as required	2000
Brian Pastures R S	Gayndah	BULS	*Aeschynomene brasiliana*	Monitor and treat as required.	2000
Brian Pastures R S	Gayndah	ACIAR	*Leucaena* spp.	Clean of non-cultivars, monitor	2002
Brian Pastures R S	Gayndah	LCS	*Indigofera schimperi*	Priority monitor and treat (#)	06/2002
Brigalow R S	Theodore	LCS	*Indigofera schimperi*	Priority monitor and treat (#)	04/2002
Emerald Research Station	Emerald	LCS	*Indigofera schimperi*	Monitor and treat as required (seedlings)	01/2002
Narayan Research Station	Theodore	LCS	*Indigofera schimperi*	Clean, monitor	05/2002
Kookaburra	Wondoan	LCS	*Indigofera schimperi*	Priority monitor and treat as required (seedlings)	01/2002
Kapalee	Biloela	LCS	*Indigofera schimperi*	Clean	01/2002
Rangeview	Theodore	LCS	*Indigofera schimperi*	Priority monitor and treat as required (seedlings)	02/2002
Birrong	Springsure	LCS	*Indigofera schimperi*	Monitor and treat as required (seedlings)	01/2001
Goondooroo	Springsure	LCS	*Indigofera schimperi*	Monitor and treat as required (seedlings)	01/2001
Mutation	Clermont	LCS	*Indigofera schimperi*	Monitor and treat as required (seedlings)	01/2001
Bindaroo	Roma	LCS	*Indigofera schimperi*	Clean	01/2001
Kiamanna	Arcadia	LCS	*Indigofera schimperi*	Clean	01/2001
Carramah	Capella	LCS	*Indigofera schimperi*	Clean	01/2001
Ellenvale	Chinchilla	LCS	*Indigofera schimperi*	Clean	01/2001
Grosmont	Wandoan	WRCD	*Indigofera schimperi*	Monitor and treat as required (seedlings)	01/2001

site ploughed and cropped to wheat

Table 5 (cont) References

A complete list of all accessions sown at most sites is given in the following relevant references:

+ Bishop et al. (1996) Back Up Legumes for Stylos Interim Final Report MLA Project DAQ.083.

“ Clem, R.L. *et al.* (2000?) Early stage evaluation of tropical legumes on clay soils at three sites in central and southern Queensland. *Tropical Agriculture Technical Memorandum No. 6, CSIRO Tropical Agriculture, Brisbane, Australia.*

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* Jones, R.M. and Rees, M.C. (1997) Evaluation of tropical legumes on clay soils at four sites in southern inland Queensland. *Tropical Grasslands*, 31, 95-106.

= Strickland, R.W., Greenfield, R.G. and Hacker, J.B. (2000) Preliminary evaluations of exotic grasses and legumes for forage potential in south-west Queensland*., Genetic Resource Communication No. ? , CSIRO Tropical Agriculture, Brisbane, Australia.*

Contacts for the sites listed above would be:

1-9 Cam McDonald and Dick Jones

10-14 Bob Greenfield

15-17 Bob Greenfield and Richard Silcock

18-20 Rollo Waite and Bryan Hacker

21-22 Bruce Rutherford (Davies) and Chris McSweeney (Long Pocket)

[note that Greenfield, Hacker, Jones and Waite have retired from CSIRO]

Table 6. Discontinued CSIRO Trial sites containing target plants (Cam McDonald CSIRO Indooroopilly, Bruce Rutherford CSIRO Lansdown/Davies Lab Townsville, Richard Silcock DPI Toowoomba and Chris Gardener, JCU Townsville

Site	Town	Project	Target species	Action	Last Visit
Glenbower House	Pittsworth		*Indigofera schimperi* *	Almost clean, monitor and treat	05/2002
Glenbower Dam	Pittsworth		*Indigofera schimperi* *	Almost clean, monitor and treat	05/2002
Kindon	Millmerran		*Indigofera schimperi* *	Almost clean, monitor and treat	05/2002
Boongargil	Toobeah		*Indigofera schimperi* *	Almost clean, monitor and treat	05/2002
Sunset Downs	Tara		*Indigofera schimperi* #	Clean	05/2002
Bellcrest	Wandoan		*Indigofera schimperi* #	Almost clean, monitor and treat	05/2002
Narayen	Munduberra	*LCS*	*Indigofera schimperi* *	Almost clean, monitor and treat	05/2002
Narayen other brigalow	Munduberra		*Indigofera schimperi* "	Almost clean, monitor and treat	05/2002
Narayen	Munduberra	BULS 2 & 3	*Aeschynomene brasiliana* +	Monitor and treat	05/2002
Brumich site B	Augathella		*Indigofera schimperi* =	Clean but monitor	
Brumich site H	Augathella		*Indigofera schimperi* =	Clean but monitor	
Pinnacle site M	Augathella		*Indigofera schimperi* =	Clean and monitor	
Pinnacle site S	Augathella		*Indigofera schimperi* =	Sprayed 1999, monitor	1999
Glen Eden	Augathella		*Indigofera schimperi* =	Clean but monitor	
Norton	Roma	DAQ.13P	*Indigofera schimperi* =	Monitor and treat	2 / 2002
Ula Ula	St. George	DAQ.13P	*Indigofera schimperi* =	Monitor and treat	3 / 2002
Woodbine	St. George	DAQ.13P	*Indigofera schimperi* =	Clean	3 / 2001
Karoola	Surat		*Indigofera schimperi*	Clean	
Riverstone	Bonshaw		*Indigofera schimperi*	Clean	
Avondale	Texas		*Indigofera schimperi*	Clean	
Davies Lab	Townsville		*Acacia spp.*	Monitor and treat	2002
Lansdown RS	Woodstock		*A.angustissima, Leucaena*	Monitor and treat	2002
Lyndon Caves	Roma	DAQ.13P	*A. augustissima*	Monitor and treat	2/ 2002
Woodbine	Nindigully		*Indigofera schimperi*	Clean but monitor	3 / 2001
Mulga View	St George	DAQ.13P	*Indigofera schimperi*	Clean	
Bringalily	Millerran		*Indigofera schimperi*	Clean, monitor > drought	12/2001
Grosmont	Wandoan		*Indigofera schimperi*	To be inspected	2/2002

5. Success in achieving project objectives

To compile a register of forage plant evaluation sites established by QDPI and CSIRO in Queensland since 1986. Known earlier sites where target plants were sown will also be monitored.

The QPASTURES data base is a good indicator of where target plants have been sown in Queensland and it was used to flag potential 'hot' sites at the start of this project. However there is still a lot of data (detail of property sites, species/accession lists and performance) to be entered into this data base. The 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 can input results directly to it. Mr Bob Walker did this very extensively for older projects from NQ.

To develo and implement a management plan for old, discontinued evaluation sites.

This project has greatly increased discussion and planning on the potential risk of trial species/accessions "escaping" from evaluation procedures/sites and becoming environmental weeds. These project activities are helping to develop a culture of environmental responsibility with regard to evaluation of introduced forage plants.

Concurrent with this project the multi-agency North Australian Pasture Plant Evaluation Committee (NAPPEC) has been developing new, more appropriate evaluation procedures for future introduced forage plant cultivars, including plans and protocols to greatly reduce the risk of non-cultivar plants escaping. These new guidelines are presented in section 6.

To monitor, contain, and if possible, eradicate currently identified, and potential "of concern" and "target" 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. The four plant evaluation projects funded by MLA's North Australian Program from 1987 to 1998 (see section 3, Methodology) formalised and more appropriately structured the introduced forage plant evaluation process in northern Australia and 28 forage plant cultivars (15 legumes and 12 grasses) were released over this period.

With hindsight having such a large network of evaluation project sites plus additional on-property adaptation sites under grazing increased the risk/opportunity for "environmental weeds" or "weeds of disturbance" to escape. However a combination of "duty of care" procedures and new "codes of practice" from research agencies, community awareness of environmental weed issues and AQIS legislation, will ensure that future plant evaluation procedures will present minimal environmental risk.

Total eradication of legume target plants has not yet been achieved where soil seed reserves have accumulated. However this project has successfully contained and reduced plant and seedling populations. This is demonstrated in Table 4 of section 4.2 of report.

To record procedures and document results, for development of a site management manual.

A separate site management manual will not be prepared as an outcome of this project as NAPPEC has, for a number of years, been developing an evaluation "code of practice" as part of a wider review of introduced forage plant evaluation procedures. The MOPES project team has been working closely with NAPPEC during this period and its new "Draft Code of Practice" is presented in appendix 10.8.

6. Impact on meat and livestock industry

1. The MOPES project has furthered the working relationship between RD&E agency staff and land holders in the overall fodder plant evaluation process.

2. The MOPES project has helped develop a more "environmentally aware" culture amongst RD&E agencies and land managers. This new awareness and the new draft code of practice for future forage plant evaluation programs will ensure that responsible and strategic use of sown pastures will continue to complement our extensive native pasture grazing systems. This project and associated NAPPEC activities was necessary and timely to counter the growing perception that most of the so called exotic environmental weeds were the result of tropical pasture evaluation programs. For example, Low (1997) states that because of the deleterious effects of exotic grasses, and twining and woody legumes, all future research should be directed towards developing native legumes and grasses.

3. The MOPES project has lead DPI and land managers into a closer working relationship with, and trust between the so called "greener", "anti-exotic" government agencies (EPA and NR&M). This has, and will in the future, lead to better balanced "codes of practice", as in the continued use of leucaena, ponded pasture and introduced grass/legume grazing production systems.

4. Prior to its disbandment at the March 2002 meeting, the Northern Australian Pasture Plant Evaluation Committee (NAPPEC) finalised a **draft Code of Practice** which is presented in Appendix 10.8. NAPPEC is a group drawing its membership from most organisations involved in species research in northern Australia, as well as from the Environmental Protection Agency and Natural Resources and Mines Departments. If adopted, this Code of Practice will help to ensure that future MOPES projects will be unnecessary. No system can guarantee that varieties that can pose some weed problem to some other member of the community will not be released. However the Code provides sufficient safeguards to reduce the likelihood of releasing an environmental pest to an absolute minimum. Strict adherence to the Code, for future evaluation programs, will lead to considerably longer projects for cultivar release.

7. Conclusions and recommendations

1. Management of old plant evaluation sites (monitoring, containment and eradication activities) need to continue for another 3 to 4 years to build on the progress made during this initial three year project. In a MOPES 2 project a “risk assessment” and sub-catchment approach for “target plants” should be considered.

2. Strong links need to be made with the NR&M Strategic Weed Eradication and Education Program (SWEEP) team in any ongoing project, plus continuing links with the other participating inter-agency groups such as the replacement group for NAPPEC, NR&M, EPA and their weed committees.

3. The development of up-to-date information packages on the role, production and sustainable grazing management benefits provided from currently available pasture cultivars is a priority, before all of the “older” experience from RD&E agencies is lost. “Smart” application of sown pasture technologies and grazing management practices, through access to user-friendly information packages, will build a positive and responsible sown pasture development culture amongst researchers and land managers.

4. 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.

5. Short term funding for short term evaluation projects, which specify the release of a stated number of cultivars, can lead to premature release prior to appropriate assessment of palatability and weed potential. The problem “target” species addressed in MOPES are largely a direct result of the expectation of cultivar release from short term projects. Although many of the earlier-released cultivars have acquired a reputation for weediness, these, with the exception of *Andropogon gayanus*, are NOT environmental weeds, but weeds of disturbance. Earlier cultivars were all products of exhaustive evaluation, often taking a decade or more from first planting to cultivar release. The need for the MOPES project provides a valuable lesson to all associated with forage plant evaluation programs. If further plant evaluation is required in the future, as it almost certainly will, a more realistic and cautious approach to the process will be necessary.

6. Positive case studies prepared by land holders / land managers and DPI, on the economic and environmental benefits from responsible use of sown pasture development and their integration into whole enterprise production systems, need to be published in all media forms and forum events.

8. Acknowledgements

Land holders/managers and Research Stations, on whose properties these evaluation sites were established, are acknowledged and thanked for their input, assistance and responsible and cooperative support with both the original evaluation projects and subsequent containment and eradication activities. Meat and Livestock Australia is acknowledged for its commitment to the operational segment of the MOPES project. The participation and advice provided by Steve Csurhes, NR&M and George Batianoff, EPA at the project review workshop is also acknowledged and appreciated.

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10. Appendices

10.1 Cost/benefit justification for project

Introduced pasture plants have been purposefully and accidentally introduced into northern Australia in the past, and have impacted in both a positive and negative manner on various systems (Chudleigh and Bramwell 1996). Their report, "Assessing the impact of introduced tropical pasture plants in northern Australia", prepared for the CSIRO task force interested in introduced pasture plants and sponsored with funds from (then) MRC, is the most comprehensive study to date which looks at both the positive and negative impact of introduced pasture plants on various production and ecological landuse systems in northern Australia.

Their deliberations and findings are therefore quite relevant to any cost benefit analysis of our project 'Managing old (discontinued) plant evaluation sites". However **the main difference is that our project is targeting introduced plants (mainly exotic legumes) which have not been approved for release as commercial cultivars** but yet are showing some adaptation to the northern Australian environment at the field sites where they have been evaluated. Also, in preparing their Benefit/Cost analysis for buffel grass and for stylos, **Chudleigh and Bramwell did not quantify the negative impact costs.**

The Chudleigh and Bramwell 1996 report states in the summary and conclusions (selected parts) that:

"The **negative impacts of introduced pasture plants have only recently been regarded as important in northern Australia.** The major negative impacts of introduced pasture plants are a result of the unintentional invasion of these plants into areas where they are unwanted. This can result in loss or deterioration of native ecological systems; reduction of plant and animal biodiversity in certain systems; loss of production (e.g., cropping or horticultural systems); soil degradation in some areas; and other minor negative impacts. Introduced pasture plants commonly invade disturbed areas such as roadsides, creeklines, floodplains, and other areas.

Exotic plants that impact in a negative manner within northern Australia have been introduced through various means, and it is unjust to single out the RD&E effort involved in identifying suitable plants, experimenting with these plants, organising the official release of these plants, and so on. Some of the worst environmental weeds have been introduced for ornamental reasons, through accidental introductions, as contaminants in other material, and via individuals importing seed for release outside any formalised scientific effort. Further, many introductions were made a long time ago and it is probable purposive introductions were made with good intent at the time.

It is important not to attempt to apportion responsibility for past introductions of plants, but to **look to the future to ensure that undesirable plant introductions are minimised or do not occur at all.** A part of this might be to **identify any weaknesses in Australia's plant introduction controls** with respect to both general importation procedures **as well as those that can be more readily formalised through official testing and release protocols.**

Apart from situation analyses or resource monitoring studies, and identifying weaknesses in import and release mechanisms, **other useful projects could be mounted with respect to alternative control mechanisms** for introduced pasture plants impacting in a negative manner, and the economics of cost of control. The latter could be useful to individual landholders, local authorities and state and Commonwealth governments as these persons and organisations are responsible for control decisions. However, **the economics of control would also depend on factors such as how society values various weed free environments".** (end of quote)

Potential negative impacts of environmental introduced weeds could include:

1. Loss of or reduced pasture production through physical competition.
2. Loss of or reduced animal production through low palatability.
3. Increased soil erosion through reduced pasture cover (competition from shrubby legumes).
4. Restricted stock movement, access and mustering (browse shrubs).
5. Checking/blocking of drains, dams and streams.
6. Invasion of roadsides, gardens, national parks and any disturbed areas.
7. Invasion of cropping areas, pasture seed crops, and tree crops.
8. Alteration of ecology and loss of habitat.
9. Loss of biodiversity (plants and animals).
10. Cost of controlling “weeds” and environmental impact of increased herbicide usage.
11. Cost of control measures may change viability of enterprises.

Costs and benefits of/from likely outcomes of proposed new project

The **COSTS** of implementing this project (various monitoring, management and control activities) will be the project budget (contribution from MLA, QDPI, CSIRO and other direct and in-kind contributions). These can be totalled at the completion of the project, but are budgeted in this application. Based on experience from this project and results achieved at evaluation sites, the cost/ha for controlling various potential weeds can than be calculated.

For this project stopping or preventing any or all of the above listed "potential negative impacts" would be regarded as **BENEFITS.** The benefits actually equal the control costs which could occur for various enterprises (if plants escaped), cost of reduced incomes or cost of diminished community value placed on natural systems, potentially caused by escaping, unreleased, introduced, exotic pasture plants. These defacto “benefits” are much more difficult to calculate. The Chudleigh and Bramwell report states:

> *“It is difficult to qualify the negative impacts of introduced pasture plants upon various land classifications, as limited work on this topic has been conducted or published, and further, the importance of the impacts is highly subjective and opinion would vary from one person to another.”* (page 22).

In presenting the Benefit-Cost ratio for buffel grass and for stylos, their report calculated costs as the cost of RD&E, cost of pasture establishment and maintenance and cost of investment capital in additional cattle. The negative impact costs were not quantified as a cost due to difficulty in calculating a realistic value.

Costs associated with the negative impact of the following "weeds", classified by their escape mechanism, increases progressively and significantly.

1. Escape from structured evaluation process - (siratro, glycine, stylo, buffel grass)
2. Escape from unsophisticated evaluation process - (prickly acacia, para grass, red natal grass, guinea grass, thatch grass)
3. Escape as contaminants in introduced pasture seed - (GRT, parthenium, sickle pod)
4. Accidental escape, not related to pastures - (prickly pear, mother of millions, rubber vine, grader grass)

In general terms pest plants cost Australia more than $3 billion each year through losses to production and the cost of control; Rubber vine $8 million, Parthenium $16.5 million, Lantana $17 million (Lazzarini and Kelly, 1998).

As plant evaluators we feel that one can never be sure about the weed potential of any plant but that expression of weed potential can be minimised by a responsible and structured evaluation process, combined with a sincere ongoing monitoring program to keep a watchful eye on potential problems.

Long term monitoring of discontinued plant evaluation sites also has the potential to identify **beneficial** new cultivars. Examples of "long term stayer" releases include Hatch bluegrass, Milgarra butterfly pea, Amarillo forage peanut and Shaw creeping vigna.

10.2 History of fodder plant evaluation in Queensland

Prior to 1987, pasture species evaluation in northern Australia was largely carried out on an individual basis, focusing 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 m^2, 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.

10.3 Detailed site management report for North Queensland Seasonally Dry Tropics

Management of discontinued forage plant evaluation sites

Dry Tropics of North Queensland
R.W.Walker
Milestone Report July 2002

The introduced forage species targeted for eradication as having the potential to develop into environmental weeds include accessions within the genera *Acacia, Aeschynomene and Indigofera.* Sixteen discontinued pasture plant evaluation sites have been identified from the QPASTURES database in which the accessions were sown. Details are shown in the following prioritised table.

Site	Town	Project	Target species	Accessions	Action
Batavia Downs	Weipa	Mba P38.7	*Aeschynomene brasiliana*	92519, 93592	High priority treatment
		"	*Aeschynomene paniculata*	93653	**High priority treatment**
Sugarbag	Mt Garnet	Mba.Uncat.92	*Aeschynomene brasiliana*	92519, 93592	Introduce competitive grass
		Mba Uncat 94	*Aeschynomene brasiliana*	92519	Introduce competitive grass
Burlington	Mt Surprise	Mba P38.4	*Aeschynomene brasiliana*	92519, 93592	Monitor, treat as necessary
Lamonds Lagoon	Mt Garnet	Mba.Uncat.92	*Aeschynomene brasiliana*	935921	Monitor, treat as necessary
Wrotham Park	Chillagoe	BRP P218.9	*Indigofera schimperi*	16055 69495 73608	Monitor, treat as necessary
Walkamin R.S.	Walkamin	WRS P48.14	*Acacia angustissima*	84971	**Priority treatment**
		"	*Acacia sp*	85001	**Priority treatment**
Springmount	Mareeba	Mba P38.7	*Aeschynomene brasiliana*	92519, 93592	Monitor, treat as necessary
Double Lagoons	Normanton	Mba P38.7	*Aeschynomene brasiliana*	92519, 93592	No further action required
Lucky Downs	Greenvale	Mba P38.7	*Aeschynomene brasiliana*	92519, 93592	No further action required
Milgarra	Normanton	Mba Uncat 87	*Aeschynomene brasiliana*	92519, 93592	No further action required
		"	*Aeschynomene paniculata*	93653	No further action required
Mt Surprise	Mt Surprise	Mba Uncat 87	*Aeschynomene brasiliana*	92519, 93592	No further action required
		"	*Aeschynomene paniculata*	93653	No further action required
Mt Webb	Cooktown	Mba P38.7	*Aeschynomene brasiliana*	92519, 93592	No further action expected
Southedge R.S.	Mareeba	Mba P39.13	*Acacia sp*	grouped	No further action expected
		Mba P39.1	*Aeschynomene brasiliana*	92519, 93592	No further action expected
		"	*Aeschynomene paniculata*	93653	No further action expected
Woodview	Normanton	Mba Uncat 87	*Aeschynomene paniculata*	92519, 93592	No further action required
Yaramulla	Mt Surprise	Mba P38.7	*Aeschynomene brasiliana*	92519, 93592	No further action required
Inverleigh	Normanton	BRP P218.9	*Indigofera schimperi*	16055 69495 73608	No further action required

Batavia Downs: This site is of major concern with the continued spread of *Aeschynomene paniculata*, a plant having the potential to become an environmental weed. It has spread sparsely

up too 3-4 kms from the original plot but there has been little evidence of grazing either by cattle or wallabies. The plant is erect (too 2m), few leaves, smooth pods and a prolific seeder. From recent observations it appears fairly fire resistant. It can develop into thickets if left unchecked.

Spraying seedlings with herbicide (Grazon DS) during the early “wet season” may be an appropriate control strategy. However, through the normal closure of the peninsula road during this period we have been unable to reach the site at this time. In addition it is often difficult to get around the property because of the wet conditions. Application of this herbicide after the “wet” has only been partially effective, as it is difficult to get a good spray cover with so few leaves on the plant. Graslan gives good control but its use should be avoided in timbered areas.

The future uncertainty of tenure over the property puts a high priority on the eradication of this plant because of its considered high weed potential.

Sugarbag: At this site the general consensus concludes that there is little likelihood of eradicating *Aeschynomene brasiliana*, but focusing on reducing its frequency with a strongly competitive grass. In addition too the naturalised Indian couch, this year the more dominant areas of *Aeschynomene brasiliana* were oversown with Keppel Indian couch, using the “crocodile seeder” but to date establishment has been mediocre. As an important weaner paddock with other sown legumes (stylo and cassia) herbicide treatment is not an option. The *Aeschynomene* is being grazed.

Burlington: The area was cleared in late 2001 to allow for easier access for spraying. Recorded frequency this year of *Aeschynomene brasiliana* 92519 (seedlings) was 36 percent. The plants were well grazed. No flowering or seeding evident. Indian couch spreading into the area.

As the property owner has directed that the plant be eradicated, monitoring and spraying as necessary should continue.

Lamonds Lagoon: Only a few seedlings of *Aeschynomene brasiliana* present. The paddock was heavily grazed. Plants sprayed with Grazon DS. This site is not of major concern but should continue to monitored and treated as appropriate.

Walkamin RS: A multitude of introduced pasture plants has been sown (predominantly for seed to support sown pasture research throughout Queensland) at this station since 1960. The main target genera for eradication within this project is *Acacia,* but any other target species encountered in non-arable land are treated as a matter of course.

Eradication of *Acacia* plants has been ongoing for a number of years and at present, is well in hand.

Wrotham Park, Springmount: No target plants observed this year. These sites are now not of major concern, but should be checked periodically.

Other sites listed should need no further attention.

Site profiles and progress reports

BATAVIA DOWNS (Coen)

Project No: Mba P38.7 MR
Landholder:
Queensland Government (DPI)
PMB 11
CAIRNS QLD. 4870 (phone 40603272)
Plot Location:
Latitude 120 40' 47" S
Longitude 1420 39' 48" E

Batavia Downs Station is 48km north of the Weipa turnoff on the Peninsula Developmental Road. The trial area is in a 6ha securely fenced paddock adjacent and to the south of the main cattle yards on an ironstone ridge. 4ha extending from the yards were cleared some years ago. The soil is classified as a red earth with 2ppm P.

Project area: 2ha

Species sown:
Aeschynomene americana (cv. Glenn, 53950, 91102, 91235, 93574, 93624, 93661, 93667)
***Aeschynomene brasiliana* (92519, 93592)**
Aeschynomene elegans (92523)
Aeschynomene histrix (93636)
***Aeschynomene paniculata* (93653)**
Aeschynomene villosa (93616)
Centrosema pubescens (common)
Centrosema pascuorum (cv. Cavalcade)
Chamaecrista rotundifolia (cv. Wynn, 78916, 85836, 86172, 86178, 92931, Q9862)
Macroptilium atropurpureum (cv. Siratro)
Macroptilium gracile (cv.Maldonado)
Stylosanthes hamata (cvs. Amiga, Verano)
Stylosanthes scabra (cv. Seca, Q24671)

Sowing:
Accessions were sown into the cleared and cultivated ground in 10m x 10m plots with 3 replications on the 23 October 1990. The seed was mixed with superphosphate (equiv.100kg/ha) and hand broadcast over each plot. All accessions established, but by 1994 the *Chamaecrista* lines were dominating and spreading across and away from the trial area. Trial data was recorded until 1994, after which the property was placed in a caretaker mode.

Progress:
15 July 1998: A mixture of the Chamaecrista lines has now dominated the cleared area and spread into the adjacent woodland and down a drainage line leading into Lydia Ck. Light grazing noted but limited to 15 head of weaners.
No *Aeschynomenes* recorded in the original sown area but a few *brasiliana*, *elegans* and *paniculata* plants noted 50-100m from the plots. There was no evidence of any grazing and the plants had shed their leaves and appeared not to have flowered or set seed.

20 July 1999: The *Chamaecrista* lines continue to dominate and spread as in 1998, but now with additional stock around this area are more heavily grazed.

Of concern this year is an increase in the number of plants of *Aeschynomene paniculata* in the woodland within the paddock adjacent to trial area. The 2 ha area has a plant frequency of 60%. Plants tend to be in thickets and are 1.5-2.0m in height, green, but with few leaves. Seeding has been prolific. No grazing was evident. A few plants were noted outside the fence in a lane to the west of the woodland area.

The property caretaker has not noted this plant since taking up the position in 1994. However, previously the DPI manager had taken steps to eradicate the accession, but obviously some seed has spread from the plots over the years. Overgrazing of the native grass in this area and above average summer rainfall (table below) has probably aided its establishment. Half the area sprayed with GRAZON DS herbicide at 35ml/10L

No *Aeschynomene brasiliana* or *Aeschynomene* el*egans* recorded.

***01 October 1999*:** Property burnt in a wild fire. (Manager has since reported that the fire has had little effect on the *Aeschynomene paniculata*, and has now observed some plants on the western side of Lydia Creek.

***16 November 1999*:** Narrow strips in the fenced area, 20m apart cleared through the trees, disced and oversown alternatively with *Urochloa mosambiciensis* cv. Nixon, *Bothriochloa pertusa* cv. Keppel, *Digitaria milanjiana* cv. Jarra and *Andropogon gayanus* cv. Kent at 4kg/ha together with 100 kg/ha of superphosphate and lightly covered. A reasonable strike of all sown grasses was reported by the Manager, together with a good regeneration of *Aeschynomene paniculata* seedlings. (The hot fire in October has presumably contributed to the breakdown of the legume hard seed).

***16 May 2000*:** In the sown strips, Calopo (naturalised around Batavia homestead) and mixed *Chamaecrista* accessions have grown vigorously and dominated, clearly suppressing *A. paniculata* seedlings. The frequency mean of *A. paniculata* in the sown strips was 19.8% (mainly perennials), compared with 66.7% in the intermediate areas (seedlings and perennials). Perennial plants were 1.5-2.0m in height, seeding but with little foliage. Frequency of the sown grasses was 14.3, 59.3, 62.0 and 79.2% for the cv's Nixon, Jarra, Kent and Keppel respectively.

The mean dry matter yield of *Aeschynomene paniculata* in the strips (perennial plants) was 127kg/ha compared with 382kg/ha in the intermediate areas. Keppel produced the highest yield of the sown grasses with 612kg/ha and appears strongly competitive.

Selected BOTANAL Pasture Data May 2000

Sown strip	% Frequency							
	Sown Sp	*Aesch pan*	*Calop pub*	*Cham rot*	Ver	*Seca*	*N.G. Dom**	*Forbs*
cv.Nixon	14.3	25.0	50.0	96.4	14.3	32.1	14.3	7.1
cv. Jarra	59.3	14.8	70.8	96.3	11.1	0	14.8	7.4
cv. Kent	62.0	14.3	76.2	100.0	4.8	4.8	14.3	4.8
Cv. Keppel	79.2	25.0	19.8	87.5	12.5	8.3	16.7	8.3
Native/other		66.7	22.2	86.7	22.2	17.8	46.7	8.9

The dominant* native grass was *Pseodopogonatherum irritans*
A few *Aeschynomene brasiliana* plant were recorded.

Sown strip	Paddock DM	% Comp DM				Herb species DM kg/ha			
	Kg/ha	Sown Sp	*Aesch pan*	*Calop pub*	*Cham rot*	Sown Sp	*Aesch pan*	*Calop pub*	*Cham rot*
cv.Nixon	5856	1.0	3.9	25.3	47.3	57	228	1479	2771
cv. Jarra	6192	6.0	1.2	34.1	47.1	371	76	2110	2917
cv. Kent	6185	3.1	0.7	22.9	56.4	189	40	1366	3491
cv. Keppel	4412	13.9	3.7	8.5	51.9	612	164	375	2291
Native/other	4010	9.5		7.8	46.7		382	313	1873

The *Aeschynomene paniculata* was sprayed with GRAZON DS (35ml/10L), including patches outside the fenced area and a small patch 1.9km from the homestead on the Weipa side of Lydia Ck (12^0 40' 47'' S, 142^0 39' 48'' E). The plants, having little foliage, make for difficult herbicide coverage.

***13 July 2000*:** The results of the herbicide application in May, has been accessed as only partially successful in controlling old perennial *Aeschynomene paniculata* plants. The reason for this is indicated above. Good control was achieved on the isolated plants of *Aeschynomene brasiliana.*

***31 October 2000*:** Applied GRASLAN (1-2 g/m^2) to patches around the plot and infestations reported else where on the property. The worst areas were along the western fence line and the down hill side of the plot. The fenced area was not burnt in 2000.

***29 May 2001*:** In the main generally good control achieved with Graslan particularly along the plot fence lines and other isolated patches. In the plot, dominant areas of cassia, calopo and Indian couch (cv. Keppel) were strongly competitive. Over this "wet" season more plants of *Aeschynomene paniculata* have been detected by the Manager else where on the property. Graslan was applied to the thick areas within the plot together with other patches elsewhere particularly around the cattle yards.

Selected BOTANAL Pasture Data May 2001

Paddock DM	1824 kg/ha							
Species	***Aesch pan***	***Cham rot***	***Sty sca*** **cv.Seca**	***Cal pub*** **Calopo**	***Bot per*** **cv.Keppel**	**Native grasses**	***Andro gay*** **cv.Kent**	***Uro mos*** ***cv. Nixon***
% Frequency	46.6	54.8	14.2	9.0	5.2	69.7	9.0	3.7
% Comp DM	19.7	19.7	16.1	5.2	0.7	24.2	5.9	0.7
DM kg/ha	987	987	807	263	37	1239	299	35

The odd plant of Digitaria milanjiana cv.Jarra noted but not recorded in data

04 December 2001: In a hot fire, the fenced area was burnt on the 2 December. However it was evident that where Graslan had been applied too *Aeschynomene paniculata* plants in May 2001 there was good control. Any untreated plants exhibited a high degree fire resistance. The area was oversown with Indian couch (cv. Keppel). Graslan was applied to other areas of *Aeschynomene paniculata* reported by the Manager.

16 April 2002: Frequency data recorded for Aeschynomene paniculata and Indian couch was 38 and 36 per cent respectively. Graslan applied in December was beginning to be effective.

Future action*:*

Continue herbicide application but only use Graslan as directed by the product label. Monitor the spread and competitiveness of Indian couch in the fenced area. Continue to exclude stock from this area.

Batavia Downs Rainfall (mm)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mth													
Jan	148	510	403	441	294	470	485	459	447	600	217	242	330
Feb	69	662	319	486	391	304	406	485	306	580	430	337	357
Mar	444	132	217	191	97	523	557	302	304	307	427	425	268
Apr	128	50	38	13	61	164	70	7	37	359	147	105	
May	60	1	4	18	6	17	34	0	40	1	35	0	
Jun	48	19	0	9	0	0	6	0	0	0	0	0	
Jul	3	1	3	1	0	0	5	0	0	0	4	6	
Aug	0	2	0	0	0	26	6	0	0	0	0	0	
Sep	0	0	5	0	0	0	0	0	0	0	0	0	
Oct	0	0	0	5	19	16	74	0	0	0	85	0	
Nov	0	61	2	14	0	67	142	0	165	149	201	50	
Dec	124	306	538	68	54	343	176	178	161	141	279	135	
Total	**1024**	**1744**	**1529**	**1246**	**922**	**1930**	**1961**	**1431**	**1460**	**2137**	**1826**	**1294**	
AAR	**1200**												

BURLINGTON STATION (Mt Surprise)

Project No: Mba P38.4 MR
Landholder:
D.& B.Steele
Liontown Station
CHARTERS TOWERS QLD. 4820 (phone 40625259, 47876683)
Plot Location:
Latitude 17^0 49' 18" S
Longitude 144^0 41' 38" E

Burlington station is 36km north of the Gulf Developmental Road from the road junction 15km east of Mt Surprise. At the cross roads turn left up the Bulleringa road, cross a cattle grid (2km) and go a further 200m to the bend in the road. The plot is into the left about 100m. The soil is classified as red duplex with 6ppm P.

Project area: *1ha*

Species sown:
Aeschynomene brasiliana (92519, 93592)
Chamaecrista rotundifolia (cv. Wynn)
Stylosanthes hamata (cv. Verano)
Stylosanths scabra (cv. Seca)

Sowing:
A 50m x 50m plot of each *Aeschynomene* accession was sown into undisturbed woodland on the 28 December 1986. The seed was mixed with superphosphate (equiv. 250kg/ha) and hand broadcast over each plot. Seca and Verano stylo and Wynn cassia were also sown in an adjacent area.

Progress:

26 March 1991: There were 3.61 plants/m^2 of 92519 up to50cm in height with flowers and green seed. Plants of 93592 could not be found. Good stylo and a few Wynn plants noted. The area had been burnt a couple of times since sowing.

22 July 1997: Very vigorous growth and prolific seed set of 92519 noted, but no grazing evident. No plants of 93592.

***28 April 1998*:** Area of *Aeschynomene brasiliana* 92519 now extended to 100m x 100m. Mean plant density 37.2 plants/m^2 (predominantly seedlings) at a. frequency 63%. Mean soil seed reserve was 80 seeds/m^2. Still not grazed, though the stylos that have spread into the area were well grazed.

Sprayed plants with GRAZON DS herbicide at 35ml/10L. Good control achieved.

27 April 1999: Frequency of *Aeschynomene brasiliana* 92519 plants 12% (seedlings and the odd perennial plant). Sprayed with GRAZON DS. The area was accidentally burnt on13 May.

***12 April 2000*:** Prolific seedling regeneration of *Aeschynomene brasiliana* (The hot fire in May has presumably contributed to the breakdown of the legume hard seed). The frequency was 77.3% with a dry matter yield of 559kg/ha.

Selected BOTANAL Pasture Data April 2000

Paddock DM	**1741 kg/ha**						
Species	***Aesch bra***	**cv.Verano**	**cv.Seca**	**Black Spear**	***Panicum sp.***	**Fire grass**	**Aristida Sp.**
% Frequency	77.8	13.6	6.8	63.6	36.3	52.2	9.0
% Comp DM	32.1	3.0	5.4	25.8	11.8	10.4	2.9
DM kg/ha	559	53	94	449	206	181	49

Sprayed plants with GRAZON DS herbicide at 35ml/10L. Good control achieved.

***21 March 2001*:** Frequency of *Aeschynomene brasiliana* 92519 plants 45% (seedlings only). Sprayed with GRAZON DS.

***06 June 2001*:** Good control recorded.

***09 May 2002*:** The area has been cleared to allow for easier access for spraying. Frequency of *Aeschynomene brasiliana* 92519 plants 26% (seedlings only). Plants sprayed with Grazon DS. Area heavily grazed. No flowers or seed.

Proposed future action:
Continue to monitor the site and treat as necessary.

Burlington Rainfall (mm)

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Mth													
Jan		244	69	137	147	602	51	86	68	82	337	301	432
Feb		134	263	191	11	403	274	430	64	175	58	146	90
Mar		163	0	119	152	0	0	5	54	99	113	246	116
Apr		0	0	37	23	0	12	0	0	15	36	0	69
May		0	0	8	12	0	0	0	0	14	0	0	0
Jun		0	4	40	58	0	0	0	0	0	0	0	0
Jul	0	0	0	0	12	0	0	35	0	0	0	0	7
Aug	0	0	25	0	0	0	0	0	0	25	0	0	0
Sep	0	0	0	0	0	0	19	0	0	0	0	0	7
Oct	70	0	9	9	0	0	0	00	0	57	48	0	54
Nov	0	0	82	378	0	48	73	52	0	34	44	76	162
Dec	46	53	196	315	83	71	33	37	31	41	62	476	44
Total		**594**	**648**	**1234**	**498**	**1124**	**462**	**645**	**217**	**542**	**698**	**1245**	**981**

Year	1999	2000	2001	2002
Mth				
Jan	150	172	73	283
Feb	154	302	182	417
Mar	54	4	66	14
Apr	36	132	2	23
May	0	0	0	
Jun	0	9	1	
Jul	0	0	0	
Aug	0	0	0	
Sep	0	0	0	
Oct	12	12	20	
Nov	169	169	29	
Dec	229	229	125	
Total	**804**	**1029**	**498**	
AAR	**800**			

DOUBLE LAGOONS (Normanton)

Project No: Mba P38.7 MR
Landholder:
O.& K.Brown
Double Lagoons Station
NORMANTON QLD. 4890 (phone 47453445)
Plot Location:
Latitude 17^0 19' 34" S
Longitude 141^0 17' 53" E

Travel towards Karumba from Normanton. Pass the Burke Developmental Road turnoff to Chillagoe and take the next road right opposite Maggieville station. Double Lagoons is 20km. The plots are near Forest dam which is 14km NE of the homestead. The soil is classified as a yellow earth with 6ppm P.

Project area: 0.5ha

Species sown:
Aeschynomene americana (cv. Glenn)
***Aeschynomene brasiliana* (92519, 93592)**
Chamaecrista rotundifolia (cv. Wynn, 78916, 85836, 86172, 86178, 92931, Q9862)
Macroptilium gracile (cv.Maldonado)
Stylosanthes hamata (cvs. Amiga, Verano)
Stylosanthes scabra (cvs. Seca, Siran, Q24715)

Sowing:
Accessions (except the *Aeschynomene brasilianas*) were sown into uncleared but open cultivated ground in 10m x 10m plots with 3 replications on the 23 November 1990. The seed was mixed with superphosphate (equiv.100kg/ha) and hand broadcast over each plot. There was no establishment due to flooding and the site was resown (including the *Aeschynomene brasilianas*) on the 3 December 1991. The stylos established reasonably well, but was poor for other accessions.

Progress:
31 May 1995: A few *Stylosanthes hamata* plants and the odd *Stylosanthes scabra* plant noted.

30 May 2000: The trial site area has been closed for 2 years, but is currently now open to grazing. An excellent native grass stylo (*S. scabra, S. hamata*) pasture. No *Aeschynomene, Chameacrista or Macroptilium* plants observed.

Proposed future action:
No further action necessary.

INVERLEIGH (Normanton)

Project No: BRP P217.9 MR
Landholder:

Inverleigh Pastoral Company (R.Heslin)
Inverleigh Station
NORMANTON QLD. 4890 (phone 47453474)
Plot Location:
Latitude 18^0 00' 29" S
Longitude 140^0 34' 45" E

The site is 63km from Normanton on the eastern side of the Burketown road, adjacent to where the powerlines cross the road. Inverleigh is a further 5km. The soil is classified as grey cracking clay with 4ppm P.

Project area: 0.8ha

Species sown:
Aeschynomene americana (93574, 93624)
Aeschynomene brevifolia (Q24802)
Aeschynomene histrix (93638)

Aeschynomene numellaria (Desert)
Chamaecrista rotundifolia (cv. Wynn, 16358, 37234, 86172, 93094, Q9862, Q10057, CQ1467)
Clitoria ternatea (cv. Milgarra)
Desmanthus virgatus (cv. Marc, Uman, 33201, 38351, 40071, 78382, 79653)
***Indigofera schimperi* (16055, 69495, 73608)**
Stylosanthes hamata (61670)

Sowing:
The site, on an open grassland plain, was chiselled ploughed and the accessions sown in 10m x 10m plots with 3 replications on the 3 January 1990. The seed was mixed with superphosphate (equiv.125kg/ha) and hand broadcast over each plot. Due to the dry conditions only a few *Clitoria* plants established in 1990.

Progress:
31 May 1995: A few *Desmanthus* plants noted and possibly some *Indigofera,* but difficult to determine as the site was heavily well grazed.

19 July 2001*:* Checked site. No sown species detected. Area heavily grazed.

Proposed future action:
No further action necessary.

LAMONDS LAGOON (Mt Garnet)

Project No: Mba Uncat92 MR
Landholder:
R.& R.Burge
Lamonds Lagoon Station
Mt GARNET QLD. (phone 40971481)
Plot Location:
Latitude 18^0 22' 15" S
Longitude 145^0 08' 32" E

From the Kennedy Developmental Road 3km south of Mt Garnet, follow the road towards Wairuna for 77km. Take the Glendu/Kinrara side road. The Lamonds Lagoon turnoff is 8km, with a further 3km into the homestead. The trial plot is 1km SE of the house. The soil is classified as a red earth with a low P status.

Project area: 22.0ha

Species sown:
***Aeschynomene brasiliana* (93592)**
Chamaecrista rotundifolia *(cv. Wynn, 85836, 86172)*

Sowing:
The *Chamaecrista rotundifolia* lines 85836 (10ha), 86172 (4ha) and cv Wynn (8ha) were sown in January 1992. A small area of *Aeschynomene brasiliana* (93592) was sown in February 1993. Establishment and other details are reported (Bishop 1996).

Progress:
20 May 1999: A few *Aeschynomene brasiliana* plants noted.

03 May 2000: Plants of *Aeschynomene brasiliana* are within an area of 150m x 100m.at a frequency of 37.5%. Light flowering and some green and ripe seed noted. Plant sprayed with GRAZON DS herbicide at 35ml/10L. Good control achieved. *Chamaecrista* accessions dominant for much of the area and spreading.

13 June 2001: Plants (seedlings) of *Aeschynomene brasiliana* had a frequency of 28 %, a 10 % reduction since May 2000. The paddock had been heavily grazed (including the *Aeschynomene*) and it is highly likely that the plants may not have flowered or set seed. Spraying was considered inappropriate, as plants only occurred in small patches. These were treated with Graslan. (1-2g/m^2).

08 May 2002: A few plants of *Aeschynomene brasiliana* recorded, but heavily grazed. No flowering or seeding observed. Plants sprayed with GRAZON DS.

Proposed future action:
Continue to monitor the site and treat as necessary.

Lamonds Lagoon Rainfall (mm)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Mth											
Jan	*592*	*54*	*40*	*74*	*59*	*213*	*30*	*312*	*152*	*123*	*84*
Feb	*478*	*258*	*44*	*40*	*112*	*88*	*127*	*145*	*249*	*449*	*194*
Mar	*0*	*6*	*12*	*106*	*91*	*159*	*243*	*95*	*23*	*52*	*70*
Apr	*0*	*6*	*0*	*14*	*0*	*56*	*12*	*21*	*77*	*126*	*0*
May	*31*	*40*	*0*	*3*	*29*	*36*	*58*	*73*	*16*	*14*	*0*
Jun	*0*	*2*	*14*	*11*	*0*	*6*	*0*	*10*	*0*	*65*	
Jul	*0*	*0*	*81*	*7*	*4*	*6*	*0*	*20*	*11*	*3*	
Aug	*0*	*0*	*2*	*0*	*70*	*0*	*0*	*0*	*8*	*4*	
Sep	*0*	*18*	*0*	*0*	*0*	*0*	*13*	*41*	*0*	*0*	
Oct	*10*	*0*	*11*	*5*	*56*	*56*	*0*	*142*	*11*	*2*	
Nov	*16*	*74*	*24*	*33*	*108*	*52*	*23*	*123*	*204*	*147*	
Dec	*138*	*81*	*2*	*55*	*34*	*24*	*400*	*144*	*141*	*276*	
Total	***1265***	***539***	***230***	***348***	***563***	***696***	***906***	***1126***	***892***	***1261***	
AAR	***700***										

LUCKY DOWNS (Greenvale)

Project No: Mba P38.7 MR
Landholder:
H.J.Atkinson
Lucky Downs Station
GREENVALE QLD. 4816 (phone 40885549)
Plot Location:
Latitude 18^0 59' 16" S
Longitude 144^0 51' 22" E

Lucky Downs Station (Paddys Dam out station) is 8km north of Greenvale towards the Lynd Junction on the Gregory Developmental Road. The fenced plot (1ha) is on the eastern side of the road. There is cleared paddock on the opposite side of the road. The soil is classified as a red duplex with 41ppm P.

Project area: 0.7ha

Species sown:
Aeschynomene brasiliana (92519, 93592)
Chamaecrista rotundifolia (cv.Wynn, 78916, 85836, 86172, 86178,92931, Q9862)
Desmanthus virgatus (cvs. Marc, Uman, 33201, 38351, 40071, 78382, 79653)
Stylosanthes hamata (cvs. Amiga, Verano)
Stylosanthes scabra (Q24671, Q24715, cv.Seca, cv.Siran)
Stylosanthes seabrana (104710, 110343, 11370B)

Sowing:
The accessions were sown into cleared and cultivated ground in10m x 10m plots with 3 replications on the 18 December 1990. The seed was mixed with superphosphate (equiv.100kg/ha) and hand broadcast over each plot. All accessions established, but by 1994 only the stylos (particularly the *S scabra* lines) and a few plants of *Desmanthus virgatus* (note 40071) remained.

Progress*:*
Site inspected periodically, but no A*eschynomene brasiliana* recorded.

Proposed future action:
No further action necessary.

MILGARRA (Normanton)

Project No: Mba Uncat87 MR
Landholder:
Magowra Pastoral Company
Milgarra Station
NORMANTON QLD. 4890 (phone)
Plot Location:
Latitude 18^0 06' 55" S
Longitude 140^0 52' 52" E

Travel 58km south of Normanton towards Cloncurry, cross a cattle grid and the trial area is in the paddock to the immediate left. The site is on the Balbirini Land System (open grassland plains) and the soil is classified as a grey cracking clay with 6ppm P.

Project area: 0.5ha

Species sown:
Aeschynomene americana (cv.Glenn, , 91070, 91241, 93574, 93624)
***Aeschynomene brasiliana* (92519, 93592)**
Aeschynomene elegans (92523)
Aeschynomene histrix (93636)
***Aeschynomene paniculata* (93653)**
Aeschynomene villosa (93616)
Aeschynomene sp.(91070, 91241)
Centrosema pascuorum (cv. Cavalcade)
Chamaecrista rotundifolia (cv. Wynn)
Clitoria ternatea (cv. Milgarra)
Desmanthus (suite of accessions)

Sowing:
Accessions were sown into cultivated 3m rows on the 17 December 1987. The seed was mixed with superphosphate (equiv.150kg/ha) and hand broadcast over each row. Due to the dry post planting conditions only the *Clitoria* established.

Progress:
Site inspected periodically for *Clitoria* persistence.

Proposed future action:
No further action necessary.

Mt SURPRISE (Mt Surprise)

Project No: Mba Uncat87 MR
Landholder:
M.I. M^{c}Clymont
Mt Surprise Station
Mt SURPRISE QLD. 4871 (phone 40623142)
Plot Location:
Latitude 18^{0} 10' 02" S
Longitude 144^{0} 16' 17" E

Travel 2km past the railway line crossing on the Gulf Developmental Road west of Mt Surprise. The plots are on the southern side of the road in a gutta percha poorly drained area. The soil is classified as a black cracking clay with 17ppm P.

Project area: 0.5ha

Species sown:
Aeschynomene americana (cv.Glenn, , 91070, 91241, 93574, 93624)
***Aeschynomene brasiliana* (92519, 93592)**
Aeschynomene elegans (92523)
Aeschynomene histrix (93636)
***Aeschynomene paniculata* (93653)**
Aeschynomene villosa (93616)
Aeschynomene sp.(91070, 91241)
Centrosema pascuorum (cv. Cavalcade)
Chamaecrista rotundifolia (cv. Wynn)
Clitoria ternatea (cv. Milgarra)
Desmanthus (suite of accessions)

Sowing:
Accessions were oversown into well grazed native pasture in 3m x 30m plots on the 18 December 1987. The seed was mixed with superphosphate (equiv.150kg/ha) and hand broadcast over each plot. Some *Aeschynomenes* germinated but did not persist. The *Clitoria* established, but only persisted for a couple of years.

Progress:
Site inspected periodically but no sown species observed.

Proposed future action:
No further action necessary.

Mt WEBB (Cooktown)

Project No: Mba P38.7 MR
Landholder:
Hopevale Community Council
Mt Webb Station
HOPEVALE QLD.4871 (phone 40603946)

Plot Location:
Latitude 15^0 04' 48" S
Longitude 145^0 09' 00" E

Mt Webb is 50km north of Cooktown adjoining and to the immediate south of Starke Station. The plots were 100m in and on the left, inside the fence after turning right into the property. The soil is classified as a euchrozem with 21ppm P.

Project area: 0.8ha

Species sown:
Aeschynomene americana (cv. Glenn, 53950, 93574, 93624, 93661, 93667)
***Aeschynomene brasiliana* (92519, 93592)**
Aeschynomene histrix (93636)
Centrosema pubescens (common)
Centrosema pascuorum (cv. Cavalcade)
Chamaecrista rotundifolia (cv. Wynn, 78916, 85836, 86172, 86178, 92931, Q9862)
Macroptilium gracile (cv.Maldonado)
Stylosanthes hamata (cvs. Amiga, Verano,)
Stylosanthes scabra (cv. Seca, Siran, Q24715)

Sowing:
Accessions were sown into the cleared and cultivated ground in 10m x 10m plots with 3 replications on the 13 December 1990. The seed was mixed with superphosphate (equiv.100kg/ha) and hand broadcast over each plot.

Progress:
***30.April 1991*:** Site overgrown with 3m high *Cassia obtusifolia* (sickle pod). A few *Aeschynomene brasiliana* plants only noted.

O8.April 1992: Area had been slashed recently, but apart from the odd *Chamaecrista* plant, none of the other sown legumes recorded. *Brachiaria decumbens* invading trial area.

Proposed future action:
No further action anticipated but could inspect if in the area. Permission is required from Hopevale Aboriginal Administration to enter the property.

SOUTHEDGE RESEARCH STATION (Mareeba)

Project No: Mba P39.1 MR
Landholder:
Queensland Government (D.P.I.)
Research Station
WALKAMIN QLD.4872 (phone 40929929)
Plot Location:
Latitude 16^0 58' 46" S
Longitude 145^0 20' 39" E

Travel 3km from Mareeba towards Dimbulah and turn right into Springs Road and follow the signs to the Research Station. The pasture experimental plots are in X block portion 94 (sections 7,29,30 and 31). The soil is classified as a red earth with 6ppm P.

Project area: 3.0ha

Sowing:

The Coordinated Plant Evaluation (COPE I) project was conducted at this site and included a wide range of exotic pasture legumes, grasses and browse shrubs (including *Aeschynomene, Acacia and Indigofera*). There were three sowings for suites of legumes and grasses (1988,1989 and 1990) and one for the browse shrubs (1990).

Progress:
The legume and grass species trial area has been ploughed out for alternative use. The browse shrub area ploughed out in 2002. All *Acacia* and *Indigofera* plants had been eradicated.

Proposed future action:
No further action necessary.

SPRINGMOUNT (Mareeba)

Project No: Mba P38.7 MR
Landholder:
Queensland Government (D.P.I.)
Research Station
WALKAMIN QLD.4872 (phone 40929929)
Plot Location:
Latitude 17^0 14' 26" S
Longitude 145^0 17' 57" E

From the Mareeba to Dimbulah road 1km passed the Walsh River, turn left into Springmount Rd. Travel 3.4km, veer right across the channel, then a further 3.4km before turning right into the Springmount Weir Rd. At 8.5km take the track to the left and cross a cattle grid. The plots are in to the immediate right. The soil is classified as a red duplex with 4ppm P.

Project area: 0.5ha

Species sown:
***Aeschynomene brasiliana* (92519, 93592)**
Chamaecrista rotundifolia (cv. Wynn, 78916, 85836, 86172, 86178, 92931, Q9862)
Stylosanthes hamata (cvs. Amiga, Verano)
Stylosanthes scabra (cv. Seca, Siran, Q24715)

Sowing:
Accessions were sown into uncleared and lightly cultivated ground in 10m x 10m plots with 3 replications on the 21 December 1990. All accessions established.

Progress:
Aeschynomene braziliana 93592 sprayed out a few years ago.

05 February 1998: A few plants of *Aeschynomene brasiliana* noted and sprayed with GRAZON DS herbicide at 35ml/10L

17 May 1999: A few seedlings of *Aeschynomene brasiliana* noted and sprayed. GRAZON DS herbicide at 35ml/10L

15 June 2000: No plants of *Aeschynomene brasiliana* observed.

18 July 2001: A few seedlings found and removed. These had been grazed.

27 May 2002: No plants found. Area heavily grazed.

Proposed future action:
Continue to monitor the site and spray as necessary.

SUGARBAG (Mt Garnet)

Project No: Mba Uncat92 MR and Mba Uncat 94 MR
Landholder:
R.& L. Henry
Sugarbag Station
Mt GARNET QLD. (phone 40979258)
Plot Location:
Latitude 17^0 56' 56" S
Longitude 144^0 59' 31" E

The Sugarbag turn off is 31km south of Mt Garnet along the Kennedy Developmental Road just short of 20 Mile Creek It is 8km to the station homestead and a further 4km to the trial area. The soil is classified as a yellow duplex with 3ppm P.

Project area: 40.0ha

Species sown:
Aeschynomene americana (cv. Lee)
***Aeschynomene brasiliana* (92519, 93592)**
Aeschynomene falcata (cv. Bargoo)
Aeschynomene histrix (93599, 93636, 93638)
Aeschynomene villosa (cv. Kretchmer, Reid)
Alysicarpus monilifer (52343)
Alysicarpus rugosus (51655, 69487)
Chamaecrista pilosa (57503)
Chamaecrista rotundifolia (85836, 86172, 93094)
Desmanthus virgatus (21 accessions)
Macrotyloma axillare (cv. Archer, 52469)
Stylosanthes hamata (cv. Verano)
Stylosanthes scabra (cv. Seca)
Bothriochloa pertusa

Sowing:
In the first trial 13ha of 92519 and 7ha of 93592 were sown on the 29 January 1992, together with *Bothriochloa pertusa* and 1.2t of Pasture P. An additional 10ha of 92519 and small areas of the *Chamaecristas* 85836 and 86172 were sown on the 5 February 1993. Low "wet season" rainfall restricted initial establishment.

In the second trial, these and the other accessions listed were sown in a small plot adaptation trial in 1994 but establishment was very poor and the site was abandoned.

Establishment and other details are reported (Bishop 1996).

Progress:
22 December 1999: A very *Aeschynomene brasiliana* dominant and open area was disced and oversown with *Bothriochloa pertusa* cv Keppel.at 4kg/ha. A reasonable strike reported.

16 March 2000: The strong competitiveness of *Aeschynomene braziliana* suppressed the growth of the Keppel seedlings. A proposal to spray the *Aeschynomene* with herbicide could not be carried out due to the prolonged wet weather and limited access to the site because of a flooded creek and boggy station roads. The frequency of *Aeschynomene braziliana* was 36.8% with a dry matter yield of 207kg/ha.

170 weaners were drafted into the paddock in early June through to mid July. No frosting reported so far this year.

Selected BOTANAL Pasture Data March 2000

Paddock DM	953 kg/ha							
Species	***Aesch bra***	***cv.Seca***	***cv.Verano***	**Cham rot**	***Black Spear***	**Both per***	***Forbs***	***Sedges***
% Frequency	36.8	19.4	11.6	21.7	36.8	11.2	35.3	36.8
% Comp DM	21.5	6.0	1.9	4.2	21.5	3.9	6.8	3.4
DM kg/ha	207	57	18	40	205	37	65	33

* includes naturalised Indian couch

***13 June 2001*:**

Selected BOTANAL Pasture Data June 2001

Paddock DM	1824 kg/ha							
Species	**Aesch bra**	***cv.Seca***	***cv.Verano***	**Cham rot**	***Black Spear***	**Both per***	***Forbs***	***Sedges***
% Frequency	*26.1*	*19.8*	*7.6*	*8.3*	*58.0*	*11.5*	*26.1*	*8.3*
% Comp DM	*6.7*	*9.0*	*1.1*	*2.9*	*29.3*	*3.6*	*4.3*	*1.5*
DM kg/ha	*121*	*165*	*21*	*54*	*533*	*65*	*78*	*27*

- includes naturalised Indian couch

Species	*Spor.* sp 2000	*Spor.* sp 2001	*Spor. pyr* 2001
% Frequency	*9.0*	*25.6*	*1.4*
% Comp DM	*86*	*466*	*25*
DM kg/ha	*36.8*	*31.2*	*2.6*

The data suggests a decrease of 10 % in the frequency of the *Aeschynomene brasiliana* over the year.

***28 November 2001*:** Indian couch cv. Kepple sown in strips through the paddock using a "crocodile seeder".

08 May 2002: Inspected paddock, but establishment of Keppel fairly mediocre. However that sown in December1999 now well established and beginning to be competitive. The *Aeschynomene braziliana* has grown vigorously this year but has being more readily grazed than previously.

Proposed future action:
Continue to monitor the spread and competitiveness of Indian couch. Continue to monitor the paddock and encourage the spread of Indian couch. The area is important to the grazier as a weaner paddock. (From NAPPLC meeting April 2001 this strategy appears to be the best option).

Sugarbag Rainfall (mm)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Mth											
Jan		*53*	*26*	*103*	*60*	*218*	*87*	*231*	*120*	*66*	*130*
Feb		*380*	*115*	*95*	*163*	*83*	*133*	*60*	*396*	*541*	*264*
Mar		0	64	39	79	75	305	99	56	553	106
Apr		0	0	0	0	56	0	52	33	616	
May		18	0	0	36	0	50	22	0	30	
Jun		0	0	19	12	11	12	17	0	0	
Jul	0	0	41	21	0	0	0	21	0	0	
Aug	0	0	0	0	76	0	13	10	12	0	
Sep	0	54	0	0	0	0	4	0	0	0	
Oct	0	0	0	0	21	50	3	178	0	51	
Nov	41	35	20	0	85	15	100	192	117	252	
Dec	31	74	0	67	85	124	459	119	98	127	
Total		**614**	**266**	**344**	**617**	**632**	**1166**	**1001**	**832**	**2236**	
AAR	**810**										

WALKAMIN RESEARCH STATION (Walkamin)

Project No: WRS P48.14 MR
Landholder:
Queensland Government (D.P.I.)
Research Station
WALKAMIN QLD.4000 (phone 40929929)
Plot Location:
Latitude 17^0 08' 07" S
Longitude 145^0 25' 30" E

Project area: 2.0ha

Species sown:
A multitude of introduced pasture plants have been sown (predominantly for seed to support sown pasture research throughout Queensland) at this station since 1960.

The main target genera for eradication within this project are the *Acacias,* but any other target species encountered in non-arable land are treated as a matter of course.

Progress:
Eradication of *Acacia* plants has been ongoing for a number of years and at present is well in hand.

Proposed future action:
Continue to monitor and spray with GRAZON DS herbicide at 35ml/10L as necessary.

WOODVIEW (Normanton)

Project No: Mba Uncat87 MR
Landholder:
Woodview Station
NORMANTON QLD. 4890 (phone)
Plot Location:

Latitude 17^0 45' 36" S
Longitude 141^0 00' 28" E

Travel 10km west of the Norman River bridge along the Gulf Developmental Road. The trial area is on the southern side of the road near power pole GLE 57. The soil is classified as a grey brown cracking clay with 11ppm P.

Project area: 0.5ha

Species sown:
Aeschynomene americana (cv.Glenn, 53590, 91102, 93574, 93624, 93661, 93667)
***Aeschynomene brasiliana* (92519, 93592)**
Aeschynomene elegans (92523)
Aeschynomene histrix (93636)
***Aeschynomene paniculata* (93653)**
Aeschynomene villosa (93616)
Aeschynomene sp.(91070, 91241)
Centrosema pascuorum (cv. Cavalcade)
Chamaecrista rotundifolia (cv. Wynn)

Sowing:
Accessions were surface sown into well grazed native grass in 10m x 50m single plots on the 17 December 1987. The seed was mixed with superphosphate (equiv.100kg/ha) and hand broadcast over each plot. Some accessions were resown on the 22 November 1990. Establishment was very poor.

Progress:
No long-term persistence of any accession and the site was subsequently abandoned.

Proposed Future Action:
No further action necessary.

WROTHAM PARK (Chillagoe)

Project No: BRP P218 MR
Landholder:
Australian Agricultural Company
Wrotham Park Station
Burke Development Rd.
CHILLAGOE QLD. 4871 (phone 40948333)
Plot Location:
Latitude 16^0 42' 39"S
Longitude 144^0 04' 13" E

Travel 73km west along the Burke Developmental Road from Chillagoe. There is windmill and dam on the southern side of the road. The trial site is 200m short of here on a sparsely wooded grassland area on the opposite side of the road, and in about 50m. The soil is classified as a grey cracking clay with 3 ppm P.

Project area: 0.5ha

Species sown:
Chamaecrista rotundifolia (cv. Wynn)
Clitoria ternatea (cv Milgarra, Q17476)
Desmanthus virgatus (cvs. Marc,Uman, 33201, 38351, 40071, 78382, 79653)
***Indigofera schimperi* (16055, 69495, 73608)**

Stylosanthes hamata (61670)

Sowing:
The accessions were sown into cleared and cultivated ground in 10m x 10m plots with 4 replications on the 13 December 1989.The seed was mixed with superphosphate (equiv. 120kg/ha), and hand broadcast over each plot. All accessions established.

Progress:
10 June 1998: A few plants of *Indigofera schimperi* (seedlings and perennials) recorded, some with ripe seed. Sprayed with GRAZON DS herbicide at 50ml/10L.Good control reported. Seed hand harvested and destroyed.

13 April 1999**:** A few seedlings found and pulled out. Heavy grader grass growth.

13 June 2000**:** A few seedlings found and sprayed with GRAZON DS herbicide at 35ml/10L. Heavy grader grass growth. *Dichanthium aristatum* (strongly competitive) from an adjacent old grass trial is slowly spreading from the original plots.

17 July 2001**:** 6 small plants found and removed. *Dichanthium aristatum* still spreading.

17 April 2002**:** Inspected, no plants of *Indigofera schimperi* recorded.

Proposed future action:
Continue periodic monitoring of the site.

YARAMULLA (Mt Surprise)

Project No: Mba P38.7 MR
Landholder:
Queensland Government (Dept of Enviroment and Heritage)
Yaramulla National Park
Mt SURPRISE QLD. 4871 (phone 40971485)
Plot Location:
Latitude 18^0 13' 18" S
Longitude 144^0 41' 38" E

Travel 15km along the Gulf Developmental Road from the intersection with the Kennedy Developmental Road and take the Undura Experience side road. Follow the road to the Ranger Station (14km), then a further 5km NE to the plots passing a cleared and netted fenced paddock on the right, veering right through a gateway onto an old cultivation paddock. The plots are adjacent to the fence on the left some 200m along the paddock. The soil is classified as a euchrozem with 99ppm P

Project area: 0.5ha

Species sown:
***Aeschynomene brasiliana* (92519, 93592)**
Chamaecrista rotundifolia (cv. Wynn, 78916, 85836, 86172, 86178, 92931, Q9862)
Desmanthus virgatus (cv.Marc, cv.Uman, 33201, 38351, 40071, 78382, 79653)
Stylosanthes scabra (cv. Seca)

Sowing:
The accessions were sown into cleared and cultivated ground in 5m x 5m plots with 3 replications on the 19 December 1990.The seed was mixed with superphosphate (equiv. 120kg/ha), sulfur (equiv.30kg/ha) and zinc sulphate (equiv.8kg/ha) and hand broadcast over each plot. All accessions established.

Progress:
15 October 1999: No plants of *Aeschynomene brasiliana* recorded. Some plots of the other accessions are persisting.

30 May 2000: No plants of *Aeschynomene brasiliana* recorded.

Proposed future action:
No further action necessary.

References

Bishop H.G. (Project Leader) 1996. Interim Final Report on Project Backup Legumes for Stylos (1.7.92-30.6.96). Dept. Primary Industries and Meat Research Corporation.

10.4 Detailed site management report for Campus creek, JCU, Townsville

The identification and control of *Acacia angustissima* in Campus Creek

Chris Gardiner, Cherie Ramsay and Sari Mangru
School of Tropical Biology,
James Cook University, Townsville

Acacia angustissima is an introduced shrub legume which has weedy characteristics and Bray *et al* (1997) suggests that it should not be used in agricultural programs.

A. angustissima was recorded as being present in Campus Creek, opposite CSIRO, Davies Laboratory, Townsville in 1998. Specimens were collected, pressed and subsequently identified by the Queensland Herbarium as *A. angustissima var. angustissima*. Since then, officers from the NRM Tropical Weeds Research Centre at Charters Towers and two JCU students (S. Mangru and C. Ramsay), have collaborated to map all shrubs in the vicinity of what was believed to be the parent tree and to evaluate the effectiveness of herbicide to control the spread of the shrub legume.

The source of the Campus Creek infestation was most likely to have been a very vigorous multistemed *A. angustissima* shrub which was present for many years within CSIRO, Davies laboratory grounds (see Figure 1 site18). This shrub has recently (2001) been removed. The species was possibly introduced to the Townsville region by CSIRO Division of Tropical Crops and Pastures in 1972 as part of an ongoing CSIRO pasture plant introduction program (Plant Introduction Review, 1972). Over a number of years other accessions of *A. angustissima* have been introduced (see for example: Plant Introduction Review, Vol.14, no.1/2, 1981; Vol.15, no.2 1983 and Vol. 25, no.1, 1994) and subsequently planted at a number of sites across the State in pasture and shrub/browse species trials.

In Campus Creek approximately 20 *A. angustissima* shrubs have been tagged and their locations recorded with a GPS. Figure 1 shows the location of the majority of the shrubs identified in the dry season of 2001. Due to the very dry season the identification of the shrubs was difficult as many individuals had lost much of their foliage and few pods were evident. In addition they were mostly growing in a thicket of other leguminous shrubs such as *Leucaena* spp as well as guinea grass and *Ziziphus mauritiana*. In the following wet season (2001/2002) the shrubs produced abundant lush foliage, creamy white coloured flowers, and brown pods (Figure 2), which enabled their location and identification to be confirmed.

Measurements were taken to determine some ecological characteristics such as height, habit, number of stems, stem diameter, distance from mother tree, and distance from furthest tree (Table 1 and 2).

Soon after the wet season ended (May 2002), an officer from the NRM Tropical Weeds Research Centre, Charters Towers, applied the herbicide "Access" (Triclopyr/picloram) and diesel as a basal spray (60:1) to all known *A. angustissima* plants in Campus Creek. Care was taken to ensure the spray covered the entire circumference of each stem arising from the base of the shrub to a height of approximately 50 cm. (Figure 2).

At the time of writing this report (June 2002) it appears that the Access/diesel treatment has been effective.

Ongoing monitoring, possibly for many years, of the Campus Creek infestation will be required as *A. angustissima* is long lived, a prolific seeder and is hardseeded which would suggest that a substantial soil seed bank is likely to exist.

A thicket of *A. angustissima* has also been recorded between Townsville and Ingham (15.5 km south of Ingham on the eastern side of the Bruce Highway, or 1.1km north of where Grasso's Road crosses the Bruce Highway, GPS location: 18 deg 47' 34' South 146 deg 08" 03 East). Staff of the Tropical Weeds Research Centre, Charters Towers have been notified and they have been to investigate the site and are planning a control programme.

Plants of *A. angustissima* collected by C.Gardiner in a discontinued research plot at *"Rosebank"* DPI Research Station, Longreach have also been confirmed by the Queensland Herbarium as being *A. angustissima.* It is not known if any control measures have been undertaken at that site.

Table 1. Ecological characteristics of* A. angustissima *found at JCU Campus Creek, 2001

Tree	Dist. (m) to mother tree	Height (m)	Habit	No. of stems	Diameter @ 20 cm	Average Dia. (cm)
1	185	3.8	Erect; coppicing from fallen tree	9	20;14;11;12;15;17;12;13	12.6
2	163	3	Erect	1	63	63
3	181	3.1	Erect	2	32	32
4	207	4.7	Erect	1	10;26;63	33
5	125	3.6	Erect; coppicing from fallen tree	9	24;40;37;25;56;56;10;14;37;28	36.3
6	264	3.3	Erect; multi-stemmed	10	10;13;12;19;15;18;31;19;16;13	16.6
7	259	2.8	Erect; multi-stemmed	7	19;18;19;20;20;22;18	19.4
8	230	4	Broken at stem junction; borer present	1	47	47
9	211	2.8	Erect; no leaves	1	23	23
10	183	3.1	Erect	1	25	25
11	188	3.9	Coppicing from fallen tree	~15	10;10;24;20;22;26;19;21;18;23;27; 10;10;12;13	17.6
12	201	2.4	Erect	1	30	30
13	201	2.6	Leaning	3	23;52;39	38
14	205	1.9	Erect	1	9	9
15	212	3.6	Leaning	2	52;12	32
16	212	4.3	Erect; multi-stemmed	12	26;9;33;29;12;25;22;9;11;13;12;12	17.8
17	235	4	Coppicing from fallen tree	6	28;24;14;17;15;72	28.3
19	554	2.9	Erect; multi-stemmed	3	13;36;10	19.6

Additional notes:
Flowering in May
Average 4.5 seeds per pod

Table 2 Location and distance spread of A. angustissima from parent tree

From	To Tree	Distance (m)	Number	Easting	Northing	NAME
Palmetum	1	557	1	475275.00000	7863779.00000	Site
	2	519	2	475288.00000	7863814.00000	Site
	3	513	3	475272.00000	7863820.00000	Site
	4	552	4	475250.00000	7863783.00000	Site
	5	505	5	475328.00000	7863835.00000	Site
	6	457	6	475198.00000	7863876.00000	Site
	7	453	7	475202.00000	7863877.00000	Site
	8	455	8	475229.00000	7863876.00000	Site
	9	464	9	475244.00000	7863866.00000	Site
	10	410	10	475302.00000	7863927.00000	Site
	11	403	11	475301.00000	7863936.00000	Site
	12	386	12	475301.00000	7863955.00000	Site
	13	386	13	475301.00000	7863957.00000	Site
	14	371	14	475304.00000	7863966.00000	Site
	15	364	15	475302.00000	7863972.00000	Site
	16	364	16	475302.00000	7863970.00000	Site
	17	348	17	475281.00000	7863983.00000	Site
	CSIRO	554	18	475453.00000	7863824.00000	CSIRO
			19	475243.00000	7864330.00000	Palmetum
CSIRO	1	185				
	2	163				
	3	181				
	4	207				
	5	125				
	6	264				
	7	259				
	8	230				
	9	211				
	10	183				
	11	188				
	12	201				
	13	201				
	14	205				
	15	212				
	16	212				
	17	235				

Figure 1. Map of infestation of* A. angustissima *in Campus Creek, Townsville

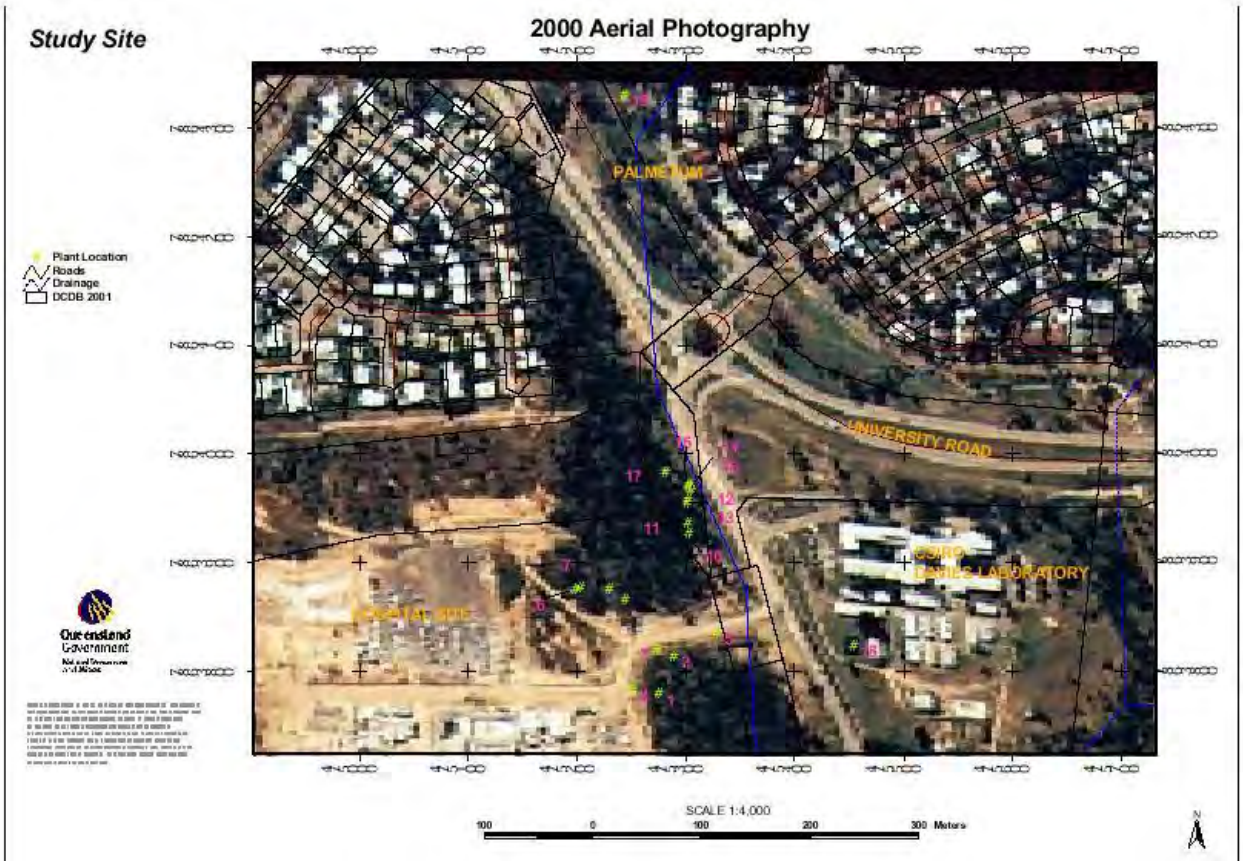

Figure 2. Images of A. angustissima

Habit of A. angustissima *in dry season*

Inflorescence and foliage of A. angustissima

Pods of A. angustissima

Basal spraying of A. angustissima

References

Bray, R.A., Palmer, B. and Ibrahim, T.M. (1997). Performance of shrub legumes at four sites in Indonesia and Australia. *Tropical Grasslands* **31**(1):*31-39*.

Plant Introduction Review (1972) Vol. 9, No. 1

Plant Introduction Review (1981) Vol. 14, No. 1/2

Plant Introduction Review (1983) Vol. 15, No. 2

Plant Introduction Review (1994) Vol. 25, No. 1

Literature review of *Acacia angustissima*

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Australia

Botany

Acacia angustissima, also known as the fernleaf acacia, is a thornless shrub or small tree from 2 to 7m high with a single short trunk. Branchlets can range from glabrous to covered in short appressed hairs. Stipules scarious, oblong c. 3 x 1 mm, caducous ((Miller) Kuntz 1898). Leaves bipinnate, 10 – 20cm long and scattered on stem with 10-20 pairs of pinnae without secondary venation (Turner 1996). Flowers whitish, 5-merous, all parts glabrous; calyx deeply lobed, 2.5 – 3mm long; stamens extremely numerous (100 or more), 5 – 5.5 mm long with minute anthers c. 0.1 mm long ((Miller) Kuntz 1898). It was observed in 1994 by Dzowela that the species flowers throughout the year in its natural range and at the end of the dry season in Zimbabwe. Pods oblong, to 6 cm long, 1 – 1.5 cm wide, transversely veined, raised over seeds and have straight or sinuate margins ((Miller) Kuntz 1898). Seeds transverse, depressed globular, dark brown, not shiny, c. 3.5cm x 2.8mm; funicle filiform, not thickened into an aril ((Miller) Kuntz 1898). The pods are initially green, turning coffee brown on ripening (Dzowela 1994).

There are six varitieties of *A. angustissima* (var. *angustissima*; var*. hirta*; var. *suffruticosa*; var. *chisosiana*; var*. leucothrix* and var. *oaxacana*) (Turner 1996).

Ecology

In its natural habitat in Mexico and Central America, *A. angustissima* can be found on rock slopes, summits and in grassland with other shrubs. It can also be found in tropical deciduous or semi-deciduous forest (McVaugh 1987). The annual rainfall of these areas varies from 895 – 2870 mm and mean temperature ranges are between 5º and 30ºC. This *Acacia* can grow from near sea level to 2600m with better growth rates at the higher elevations. At low land sites (20m) in Papua New Guinea,

A. angustissima flowered but did not seed but at the higher elevation of 1650m it seeded abundantly (Brook *et al.* 1992). Seeds appear to have a dormant period of up to a year (Echonet). This species can tolerate occasional freezing and free-draining acidic soils (Dzowela 1994) and withstand long periods of drought probably due to its considerable taproot. This *Acacia* has also been observed to retain its green foliage in the 8 month long dry season in Timor, Indonesia (FACT sheet 1994). *A. angustissima* produces weak branches which may break off when subjected to moderate to high winds. In its native habitat, *A. angustissima* is eaten by the Acacia skipper butterfly, *Cogia hippalus*, and by the moth larva of *Sphingicampa blanchardi* and *S. raspa* (Graham 1941).

With regards to its 'weediness', *Acacia angustissima* grows rapidly (5m tall and 6cm thick in 2.5 years) and responds well to regular cutting (Brook *et al.* 1992). With this kind of growth rate it is not surprising that in its home range *A. angustissima* has become weedy and forms thickets along roadsides and in sandy soil in pastures (McVaugh 1987). The hard coated seeds and this species' good coppicing ability, allows a population to survive fires. Additional factors like high leaf yields, low palatability and low nutritional value to stock have caused concern among researchers in its use in agroforestry. *A. angustissima* has also shown that it could easily spread from experimental plantings due to its prolific seeding and led Bray (1997) to advise researchers that both *A. angustissima* and *A. boliviana* should not be used in future agriculture programs.

Uses

Medicinal

In its native area around Mexico, *A. angustissima* is highly regarded as a medicinal species. It is the 4th most important species used for the cure of bloody diarrhea and 7th in the treatment of mucoid diarrhea. It is also used as a cure for toothache, rheumatism and skin lesions, and is reported to inhibit growth of malignant tumors. Testing has shown that the plant has the ability to inhibit growth of certain yeasts and bacteria, including *Staphylococcus aureus*, *Bacillis subtilis*, *Klebsiella pneumoniae* and *Candida albicans*, indicating its potential for use against human diseases caused by these organisms. The bark is also used in Mexico to precipitate mucilaginous matter and induce fermentation in the making of alcoholic drinks (FACT sheet 1994).

Fodder

A. angustissima is being trialled in several countries to determine its potential as fodder for livestock. This species produces large amounts of foliage and responds well to frequent defoliation. Cutting heights of 50-100 cm at frequencies of 8-10 weeks have been used in several regions (Benjamin *et. al* 2000). Biomass has been reported as ranging from 10.3 t DM ha^{-1} to 11.4 t DM ha^{-1} at 2 m spacing. At 3 m spacing, the biomass increases to between 11.5 t DM ha^{-1} to 12.4 t DM ha^{-1}. The measurements were collected by cutting back trees to 50 cm above ground level during, and/or at the end of the wet season (FACT sheet 1994).

There have been conflicting reports of the palatability for livestock as a source of fodder. Some results have shown that even though *A. angustissima* produces a high leaf yield, the high tannin content and low palatability questions its value as fodder for livestock. In Indonesia though, the leaf is reported to be eaten well by livestock and is regarded as an important source of forage (Gutteridge & Shelton 1998).

Multi-purpose tree for Agroforestry

High yields and the ability to coppice well and recover after defoliation have been the main reasons for trialling this species as a multi-purpose tree in an agroforestry system. In Papua New Guinea, the shrub is used as a hedgerow, intercropped with sweet potato. It has been noted as being more successful at higher altitudes producing higher biomass and more vigorous growth (Bino 1998). In Timor, Indonesia, the closely related species *A. villosa* is used as a fallow species, which also provides fuelwood and enriches the soil prior to cropping. In Lombok, it is used on sloping sites to prevent soil erosion. In Bali, the shrub is used in a three-tier forage production system using grasses, herbaceous legumes, forage shrubs and forage trees (Gutteridge & Shelton 1998).

Other research

In 1997, Ethiopian highland sheep fed 300g of *Acacia angustissima* leaves as a supplement, died after consuming only 70-100g of leaves (Odenyo *et al*. 1997). Consequently there has been a few studies done to see if this toxicity can be alleviated. One such study was done by Saarisalo *et al* (1997) on highland sheep in Ethiopia. They added polyethylene glycol or microbes, from sheep that had been gradually adapted to *A. angustissima*, to the untreated sheep's' food. Their conclusions were that both methods alleviated toxicity since all the animals remained healthy

when given *A. angustissima* leaves as a supplement. Addition of PEG was more effective than innoculation in increasing intake and nutritive value of *A. angustissima.* Also in 1997, Osuji *et al* found that *A. angustissima* inhibited the growth of pure cultures of rumen bacteria hence the slow fermentation of the leaves in cattle.

Other research completed on *A. angustissima* have shown that :

- Intercropping with sweet potato produced lower tuber yields in the second crop (Brook 2000).
- Phenolics are the major component involved in this acacia's anti-nutritional effects (Smith *et al* 2001).
- At high elevation, the N release rate of the prunings may not meet peak demands of an associated crop and at low elevation, *A angustissima* provided inadequate amounts of N needed by maize in alley cropping (Isaac *et al* 2000).
- Rumen fluid from goats, gazelle, Gunther's dik-dik and impala fermented the tannin rich fodder of *A. angustissima* (Odenyo *et al* 1999).
- Milk production and growth responses of cattle using *A. angustissima* as a supplement were variable (Osuji *et al* 1997).

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10.5 Detailed site management report for Central Queensland

Management of Discontinued Forage Plant Sites

Central Queensland Region

List of Sites:

1. *Glensfield*, Sarina (BULS)
2. *Granite Vale*, St. Lawerence (BULS)
3. Miriam Vale (*Wadeleigh* & *Bethome*) (BULS)
4. Swan's Lagoon Research Station (BULS)
5. *Sorrell Hills*, Duaringa (BULS)
6. *Tedlands,* Koumala (COPE & Leg. Adptn)
7. *"Bob Fallis',* Sarina (Leg. Adptn.)
8. *Oxford Downs,* Nebo (Leg. Adptn. & LCS)
9. *Lynford,* Nebo (Leg. Adptn.)
10. *Goorganga,* Proserpine (Leg. Adptn.)
11. *Crediton,* Eungella (Leg. Adptn.)
12. *Eungy,* Valkyrie Access Road (Leg. Adptn.)
13. *"Glen Gough",* Proserpine (Leg. Adptn.)
14. *Wilunga,* Nebo (BULS &COPE)
15. *Waverley Station,* St. Lawerence (Leg. Adptn.)
16. *Carmilla Glen,* Carmilla (Leg. Adptn.)
17. *Rolfe Park,* Middlemount (LCS)
18. Gallway Plains, Calliope (COPE)

Spray Treatment:

- Advice on the spray mixture used was given by Don Loch (DPI, Gympie).
- Initially spray mixture used was Brushkiller 600 (a.i. *metsulfuron methyl*) and Banvel 200 (*dicamba*) plus a non-ionic wetter.

  Brushkiller - 7.5g/ha
  Dicamba - 750 ml/ha.
  Wetter - 1 ml/l

- In the 1999/00 summer after Don Loch's final report on herbicide screening of the targeted legume it was decided to not include Banvel in the mixture.

Site: **Glensfield**
Property Owner: John & Rosalie Cox
Location: Blue Mt. Road
Sarina Shire
21deg 28.0min S, 145deg 58.0min E (to be checked by GPS)

Accessions Planted:

Aeschynomene americana	Glenn;Lee;91235;93624;
Aeschynomene brasiliana	92519;93592;
Aeschynomene falcata	Bargoo
Aeschynomene histrix	93593;93636;93638;
Aeschynomene villosa	37235;91209;93621
Alysicarpus monilifer	52343;
Alysicarpus rugosus	51655;69487;
Atylosia sericea	30042;
Chaemaecrista pilosa	57503;Col's (57503)
Chamaecrista rotundifolia	Wynn;85836;86172;93094
Desmanthus virgatus	30205;33201;37538;38351;40071;49728;52401;55719;67643;78372; 79653;85178;90754;TQ90;BBAC10;BBAC11;Marc;Bayamo;Uman
Macroptilium atropurpureum	Aztec;84989
Macroptilium axillare	Archer;52469
Stylosanthes hamata	Verano;Amiga
Stylosanthes scabra	Seca;Siran

Activities:

16/5//94	Commenced spray-out of A.brasiliana 93592
22/12/94	Sprayed A.brasiliana 93592
28/2/95	Sprayed A.brasiliana 93592
24/11/95	Sprayed A.brasiliana 93592
17/7/96	Sprayed A.brasiliana 93592
17/1/97	Discussed with cooperator about the need for closed grazing when legumes are in seed. No concern about Wynn as it is planted elsewhere but because of A.bra care is required
14/2/97	Sprayed A.brasiliana 93592`
15/5/97	Sprayed A.brasiliana 93592
15/1/98	Sprayed A.brasiliana 93592
21/4/98	DM yields from exclosures on Wynn & 92519 – showed legumes are being utilised as 2-3 times more legume when ungrazed
13/8/98	Seed dropped from 92519
25/9/98	Sprayed A.brasiliana 92519,93592
14/4/99	Very heavy grass growth as has been shut up since Nov 98. All Cassias spreading well out side their plots, 85836 & 86172 both well out competing with grass particularly in rep 1, not so much in rep2. Hand pulled 93592 rep2 as Bissett is to baled. 92159 high population and signs of being grazed.

8/12/99 Sprayed both lines of A.bra. The frequency of 92519 was about 80% while 93592 was around 40%. Some plants observed elsewhere in the site. No A.pan seen.

1/6/00 92519 no plants sighted rep 1 while rep 2 about 5-10 % freq. About same frequency for 93572 in rep 1, while in rep about 1%. Site under grazing. Sprayed with Brush-Off and wetter only.

Recommendation (as of Jul00):
Further spray treatment as required and continue monitoring the situation.

20/12/00 A low frequency of<5% was observed with the plants being small. No *A. pan* was observed. *A. bra 93592 & 92519* plots in both reps were sprayed.

6/4/01 Few plants A.bra. sighted and none of A.pan. Both reps of 93592 &92519 were sprayed.

4/01/02 Visited site – very isolated small plants of both A.bra. and site is open to grazing hence not a lot of grass competition. Rain did not allow a spraying and shall visit again in a month or so.

8/02/02 Sprayed all A.bra plots – only isolated small plants.

Site: Granite Vale
Property Owner: Joe Olive
Location: St. Lawrence
Broadsound Shire
22deg 34.61min S, 149min31.96 E BULS site

Accessions Planted:
Legume Adaptation -: (next gate past BULS and drive to and then around the ponds and south to a gate and site is adjacent to creek – several Kms in)

Aeschynomene americana x 7
Aeschynomene brasiliana x 2
Asechynomene elegans
Aeschynomene falcata
Aeschynomene histrix
Aeschynomene paniculata
Aeschynomene villosa x 2

BULS -: (east of h'way, on fence line, south of the standing timber)

Aeschynomene americana	*Glenn;Lee;*56282;91235;93624;93661;
Aeschynomene brasiliana	92519;93592;
Aeschynomene falcata	*Bargoo*
Aeschynomene histrix	93593;93636;93638;
Aeschynomene villosa	37235;91209;93621
Alysicarpus monilifer	52343;
Alysicarpus rugosus	51655;69487;
Atylosia sericea	30042
Chaemaecrista pilosa	57503;Col's (57503)
Chamaecrista rotundifolia	*Wynn;*85836;86172;93094
Desmanthus virgatus	30205;33201;37538;38351;40071;49728;52401;55719;67643;78372; 79653;85178;90754;TQ90;BBAC10;BBAC11;Marc;Bayamo;Uman
Macroptilium atropurpureum	*Aztec;*84989
Macroptilium axillare	*Archer;*52469

Stylosanthes hamata	*Verano;Amiga*
Stylosanthes scabra	*Seca;Siran*

Activities:

23/2/94	Commenced spray-out of A.brasiliana 93592
25/5/94	Sprayed A.brasiliana 93592
12/1/95	Sprayed A.brasiliana 93592
5/12/95	Sprayed A.brasiliana 93592
14/3/97	No plants of A.brasiliana 93592 – did not spray
21/4/98	Fair density of 92519 and only slightly grazed
16/10/98	Sprayed A.brasiliana 93592 and 92519
18/2/99	Sprayed A.brasiliana 93592 and 92519
18/5/99	v. few 92519 – plenty of grass, very good growth of Cassia on 2 & 3 plantings
20/11/99	Joe burnt whole paddock including trial area about this date. Good hot fire. Area very clean only grass shooting is all to be seen. Await next storm for subsequent spraying.
13-14/1/00	Removed fence – left strainers and gates. Left straight steel pickets and useful coils of soft heavy barb for Joe to use.
	Sprayed A.bra plots. Very few 93592 plants to be seen in either plot, while 92519 was more prevalent (approx. 50% freq). No other plants of A. bra sighted in the general area during the fencing activity. Good spraying conditions with grass still fairly short and open following burning.
1/6/00	Generally the frequency of both accessions was 5-10% and not flowering. Sprayed with Brush-Off with wetter except 93592 Rep1, could not find it as I had no plan with.

Recommendation (as of Jul00):

BULS - further spray treatment as required and continue monitoring the situation.
Legume Adaptation – inspect this summer and spray if required.

24/11/00	92519 Rep1 was 15% while in Rep 2 it was 20%. 93592 no plants sighted in Rep 1 while in Rep 2 it was 20%. All four plots were sprayed. Conditions fine with low grass cover.
04/04/01	In the BULS site scattered (<0-10% frequency) of A.bra sighted. Plants very small all A.bra. plots sprayed. While in the legume adaptation area a higher frequency of maturing plants were observed (no A. pan.). Both sites sprayed for A.bra.
11/01/02	BULS - No plants of 93592 sighted or recorded; 92519 sighted in both reps but only 1 out of 30 quads in rep 1 measured any plants. Sprayed all A.bra plots. Sprayed Legume Adaptation area for A.bra - no A.pan sighted.

Site: ***Wadeleigh & Bethome***
Property Owner: Bernie Scott (now Michael Dingle as of Jan2002)
Location: Miriam Vale/Bororen
24 deg 17.8 min S, 151deg 32.8min E, *Wadeleigh*
24 deg 10 min S, 151deg 25 min E, *Bethome*
(Note: Access to Wadeleigh is now through Bethome as the railways gate is locked)

Accessions Planted:

Aeschynomene americana	Glenn;Lee;91235;93624;
Aeschynomene brasiliana	92519;93592;
Aeschynomene histrix	93593;93636;93638;
Aeschynomene villosa	37235;91209;93621
Alysicarpus monilifer	52343;
Alysicarpus rugosus	51655;69487;
Chamaecrista rotundifolia	Wynn;85836;86172
Desmanthus virgatus	49728;52401;BBAC10;BBAC11;Jaribu
Macroptilium atropurpureum	Aztec;84989
Stylosanthes hamata	Verano;Amiga
Stylosanthes scabra	Seca

Activities:

23-27/2/94	Spray out of 93592 & 92519 commenced. T-40 (2,4,5-T) good results initially- total kill.
12/10/98	Bernie advised to apply 50kg urea/ha. This was done by the following visit.
3/11//98	Sprayed A.brasiliana 93592 and 92519
19/2/99	Sprayed A.brasiliana 93592 and 92519
21/2/00	Sprayed A.brasiliana 93592 and 92519. Frequency of both around 50-60%.

Recommendation (as of Jul00):
BULS - further spray treatment as required and continue monitoring the situation.

23/11/00	Frequency of both 92519 & 93592 in Rep 1 was about 50% while in Rep2 none were seen. Both Reps sprayed.
03/04/01	<10% frequency of both A.bra seen spraying done.
10/01/02	Frequency of 93592 was 8% (all in rep 1), while 92519 had a frequency of 30%. Plots sprayed. Property has changed hands and new owner has been contacted to gain on going access to site. Subsequently received a phone call from Michael Dingle to say continued access to monitor site is approved but as the railways gate is locked access is via Bethome.

Site: ***Swan's Lagoon Research Station***
Property Owner: QDPI
Location: Burdekin Shire
20deg 05.85min S; 147deg10.33min E

Accessions Planted:

Aeschynomene americana	*Glenn;Lee;*91235;93624;93661;
Aeschynomene brasiliana	92519;93592;
Aeschynomene falcata	*Bargoo*
Aeschynomene histrix	93593;93636;93638;
Aeschynomene villosa	37235;91209;93621
Alysicarpus monilifer	52343;

Alysicarpus rugosus	51655;69487;
Atylosia sericea	30042
Chaemaecrista pilosa	57503
Chamaecrista rotundifolia	*Wynn;*85836;86172;93094
Desmanthus virgatus	30205;33201;37538;38351;40071;55719;78372;79653;85178;90754;TQ90;BBAC10;BBAC11;Marc;Bayamo;Uman;
Macroptilium axillare	*Archer;*52469
Stylosanthes hamata	*Verano;Amiga*
Stylosanthes scabra	*Seca*

Activities:

30/9/93 93592 & Wynn high density, 92519 a bit lower density, 86172 fair density

21/3/94 extreme overgrowth of Indigofera and Convolvulus

17/10/94 93592 plants dead from previous spraying by John B.(?); seed to be seen on ground.

21/2/95 Sprayed *A.brasiliana* 93592

27/3/95 93592 plots in “dog leg” ploughed out.

20/4/95 freq of 92519 - 100%, Wynn & 86172 – 83%

21/6/95 v. little growth – Wynn best though. 92519 some green leaf attached but most has dropped.

9/2/96 Sprayed A.brasiliana 93592 RepII only, no plants evident in repI

20/3/97 heavy growth of indigofera throughout; pertusa invading from northern end though it is to be seen throughout
sprayed 93592 plots and 3m around as well – heavy grass may affect the spray effect.
Wynn well grown.

14/5/97 Seca becoming dominant in plots. At “dog leg” fair plant numbers of A.bra in west half.

18/3/98 Sprayed A.brasiliana 93592 and 92519
“dog leg” plot has some 92519 plus scattered plants throughout the timbered area

23/11/98 Sprayed whole trial site, oversowed heavy legume plots with Bothriochloa pertusa (Bowen) and dressed the whole site with 50(+) kg urea/ha

6/9/99 Negotiated with David Mims (Manager) to have site burnt in the near future, expected within two months. Inspected both sites,

1. Kelly’s Corner – Has been locked up and has a very heavy cover of grass (black spear and pertusa) probably in the region of 5-6000kg/ha. A.bra, Chamaecrista and Stylos obvious but are somewhat suppressed by the grass. Burning and spraying after germinating rain is a good option.
2. Dalrymple Dog-leg Paddock – Top area now cultivation is being auctioned and likely to be taken up by adjoining cane farm and will be cultivated hance legume should not be a problem here. Below the fence in the timbered area there is heavy grass cover, with no legumes seen on driving across area. One head seen

in the paddock. Now controlled by DNR and unlikely to be sold at this stage. Hence any management treatment will have to be negotiated with them.

23/11/99 Notified by David Mims that Kelly's Corner had been burnt. Fire was cooled somewhat by the amount of green matter but nevertheless was OK.

10/1/2000 David Mims advised about 75mm rain fell at Christmas time and only showers since – access is good at the moment.

17-19/1/00 Sprayed the whole site – good spraying conditions with grass not overgrown (except E side of Series 3 which appears to not have been burnt) and legumes not under moisture stress. Population of A.bra was variable with very high populations in some spots. In the plots the frequency of 92519 approx 60-80% while 93592 less (maybe20%).

On walking the paddock about 50m outside the fence A. bra was found in one area about 25m from the NE corner post, while a few C.rot were located along the E side of the first plating, and still further another area about 5m across of A.bra was found just over the fire break on the W side of the second plating adjacent to a log and all were subsequently spot sprayed.

Using a spreader borrowed from Joe Abela (Habana) and the tractor from the research station, 50kg/ha of granulated urea was applied to the whole area.

Staked two tyres during this operation!

6-7/6/00 Whole site had very heavy grass cover (black spear and B.pertusa) made spraying difficult and may have reduced the effectiveness of the operation. Sprayed with Brush-off and wetter only. A soak area had developed in the SE corner and was very boggy. Cassia rot. and C. pilosa very thick. With the pilosa plots very legume dominant and virtually no grass – bit of a concern! C. rotundifolia at least had good mixture of grass and legume. A. bra 92519 in rep 2 still had a frequency of about 70% but was hard to find in other plots. A couple of small plants still present outside the fence in the NE corner while still in high numbers in the area outside the SW corner over the fire-break. Plants outside the fence were not seeding while the older ones in the plots had seed which were still green. The cassias had a considerable proportion of seed as it must be earlier flowering. If Cassia was to be controlled it appears that more frequent spraying would be required.

This site takes a good two days to complete the spraying when the grass cover is high late in the season.

Recommendation (as of Jul00):

Kelly's Corner - Further spraying and continue monitoring the situation.

Dalrymple Dog-leg paddock – inspect and spray if necessary. May require consultation if the property is sold.

13-14/12/00: Completed about ¾ of Series1 but was a fairly showery day. Continued next day to finish Series 1-3, then decided to re-spray the first part of Series 1 in case of reduced effectiveness due to the showers during application. Site was fairly grassy and the occurrence of *A.bra* in Series1 is sporadic but plants are fairly thick in these spots. About 50 plants of *A. paniculata* were found in the area between plots 17 and 22. These would have been contaminants from *A. ame. 91235* (plot 22). As well as being in the sprayed area these were also hand–pulled. Still only the two sites outside the fence were located and there were frequent plants of A. bra in the S.W. of plots

and only one plant seen in the N.E. site. These sites together with one boom width outside the plots were sprayed.

26-27/03/01 Scattered plants of A.bra. observed and none of A.pan. Sprayed the whole site and a boom width outside the fence as well as an area of plants about 50m SW of trial. Grass >1m high made the effectiveness of the spraying a bit doubtful and as well seed blocked radiator on vehicle causing over-heating problems. There is a need for an early summer burn to reduce the over-growth.

4/01/02 David Mims has now left the position as manager and consequently I spoke to Dennis McLachlan (acting manager?) who told me Kelly's Corner was burnt about the 20/12/01 with only scattered storms since, though it is showery at present. Hence a likely visit in a few weeks.

31/1/02 Frequency of A. bra in the plots was 27% for 92519 and 28% for 93592; and plants generally small and not flowering. Sprayed whole site including known locations of A.bra outside. Site was burnt in early Dec 2001 hence grass cover was not too thick and good spray coverage was obtained. No A.pan seen.

02/05/02 Some rain had fallen in Feb/Mar which did germinate both legumes and provided a good grass cover. Though the density of the grass cover was not as much as the previous year due to fire in early Dec 2001. A deduction to be made from this, is that the burning is removing any depth of mulch which may help to reduce legume establishment consequently consider not burning this coming summer.

The frequency of each accession was 2.5% for A.bra 93592 and for A.bra 92519 was 7.5%. No A.pan seen and as well the Cassia accessions overall were much reduced. No A.bra plants were sighted in the area SW of plots while some were sprayed in the small depression about 30m from the NE corner.

Legume plants were fairly stressed and had just commenced flowering. A complete boom spraying was done with Brush-off / Starane mix. Conditions were fine but fairly breezy.

Site: ***Sorrell Hills,*** **Duaringa**
Property Owner: Col Dunne
Location: Duaringa Shire
23deg 34.85min S; 149deg 41.29min E

Accessions Planted:

Aeschynomene americana	*Glenn;Lee;*91235;93624
Aeschynomene brasiliana	92519
Aeschynomene falcata	*Bargoo*
Aeschynomene histrix	93593;93636;93638;
Aeschynomene villosa	37235;91209;93621
Alysicarpus monilifer	52343
Alysicarpus rugosus	51655;69487;
Atylosia sericea	30042
Chaemaecrista pilosa	57503;Col's (57503)
Chamaecrista rotundifolia	*Wynn;*85836;86172;93094
Desmanthus virgatus	30205;33201;37538;38351;40071;49728;52401;55719;79653;

	85178;90754;TQ90;BBAC10;BBAC11;Marc;Bayamo;Uman
Macroptilium atropurpureum	*Aztec;*84989
Macroptilium axillare	*Archer;*52469
Stylosanthes hamata	*Verano;Amiga*
Stylosanthes scabra	*Seca;Siran*

Activities:

3/11/98 Sprayed A. brasiliana inside and around the outside of fence - missed a small plot which was subsequently sprayed by Len Mikelsen (R'ton DPI)

10/11/98 Sent letter to cooperator re options for management. Likely to burn initially then spray and over sow with Bowen pertusa and fertilize.

22/2/00 Spoke with Col Dunne he is happy that we continue eradication of A.bra. Only a few plants and seedlings observed. Still showing some residual herbicide effect from the spraying in November. Sprayed all A.bra again. Col had thought that he may have been able to burn the site in the near future.

Recommendation (as of Jul00):

Further spraying and continue monitoring the situation. Cooperator did indicate his intention to burn the site in the future.

19/12/00 No burning done in the preceding period. A fairly high frequency of up to 50% of A.bra was observed particularly in the 1995 planting area. These were small plants and no mature plants seen. Sprayed with a mixture of Brushoff (10g/ha) and Starane (200ml/ha) as this was remaining in the tank from a spraying operation the previous day.

02/04/01 Scattered small plants observed and plot areas sprayed.

10/01/02 Series 1 92519, 52 % freq; series 3 it was 60%. Site had light coverage of grass and hence good spraying conditions. A few plants still along W fence line.

Site: ***Tedlands***

Property Owner: Tedlands Pastoral Co.
Dugald McDougall (manager)

Location: Sarina Shire
Koumala
COPE -: 21deg 36 min S;148deg 18 min E
Legume Adaptation -:

Accessions Planted:

Legume Adaptation-:
(Site adjacent to the junction of freshwater lagoon and the tidal area.)
Aeschynomene americana
Aeschynomene brasiliana
Aeschynomene paniculata
Aeschynomene villosa

COPE -:
Aeschynomene americana, A. brasiliana, A. brevifolia, A. elegans, A. falcata, A. histrix, A. paniculata, A. sensitiva, A. villosa

Alysicarpus bupleurfolius, A. longifolius, A. monilifer, A. rugosus, A. vaginalis
Arachis pintoi, A. burkartii, A. diogoi, A. glabrata, A. paraguarensis, A. pusilla, A. repens. A. stenosperma, A. villosa
Centrosema acutifolia, C. brasilianum, C. pascurorum, C.plumeri, C. pubescens, C. sag., C.schimperi, C. virginianum
Lotononis angolensis, L. bainesii, L heterophyllum
Chamaecrista biensis, C. biflora, C. mimosoides, C. pat., C. pilosa, C. rotundifolia
Cyamopsis. senegalensis
Desmantuhs brevipes, D. covellii, D. fruticosa, D. illionenis, D. sublatus, D. virgatus
Desmodium heterophyllum, D. heterocarpon, D. intortum, D. moliculum, D. procumbens, D. setergum, D.uncinatum
Indigofera schimpri
Rhynchosia aur. R. bal. R. can. R. cya., R. den., R. hir., R. mic., R. minima, R. obl., R. sch., R. tot., R. verdcourtii,
Macroptilium atropurpureum, M. lathyroides, M. longipedunculatum
Medicago sativus
Stylosanthes guianensis, S. hamata, S. scabra, S. sympodialis
Vigna afo. V. hos., V. lasiocarpa, V. parkeri, V. trilobata

Activities:

28/4/95 Sprayed A. paniculata

24/11/95 Sprayed A. paniculata

Recommendation (as of Jul00):

COPE site requires no follow up as no target plants sited
Inspect and spray adaptation plots *A. brasiliana* and *A. paniculata*.

15/01/00 *A. pan* very thick in a large area of the plot area, mainly on the ‘rise’, there has been only slight movement off the plot to below. Only a scattered few of *A. bra 93592* were sighted and none of *A. bra 92519*. Sprayed both *A. pan* and the *A.bra 93592*.

06/04/01 Previous spraying was not particularly effective as many A.pan. plants were still alive though very little seed on. Sprayed the A. pan. and adjacent area with a mixture of Brushoff and Starane.

20/12/01 Previous spraying had reduced the population of A. pan in and around the plot significantly though plants still prevalent. Attempted a spraying but had problems with the spray unit while the plot area was covered to some extent no spraying was done in the timber below the site.

24/12/01 Resprayed the plot and timbered area below with Brushoff (10g/ha) and Starane (300ml/ha) plus wetter. Found considerable areas about a 100m below the site in the timber and adjacent to the saltwater creek. This areas were boomed sprayed where access could be gained elsewhere handgun used. Spoke to Dugald (Manager) about the need to burn the timbered area to reduce the blady grass to allow a better spraying.
No A. bra sighted.

Site: *?*
Property Owner: Bob Fallis (now changed ownership)
Location: Sarina Shire
Blue Mt. Road
deg min S; deg min E
(west of Blue Mtn Rd., gate on top of ridge, head towards creek – now has new fence through site)

Accessions planted:
Aeschynomene americana
Aeschynomene brasiliana
Aeschynomene elegans
Aeschynomene histrix
Aeschynomene paniculata
Aeschynomene villosa

Activities:

22/12/94 Sprayed *A.brasiliana* 93592 and *A. paniculata*

28/2/95 Sprayed *A.brasiliana* 93592 and *A. paniculata*

24/11/95 Sprayed *A.brasiliana* 93592 and *A. paniculata*

14/2/97 Sprayed *A.brasiliana* 93592 and *A. paniculata*

7/12/99 Sprayed *A.brasiliana* 93592 and *A. paniculata* Very few *A.bra* found though *A.pan* still obvious particularly south of the new fence which dissects the site

17/5/00 Inspected site no *A.bra* or *A.pan* seen when walking overt he plots.

Recommendation (as of Jul 00):
Check site next summer and treat if required.

06/04/01 Quite a few scattered *A.pan* and fewer *A.bra. A.pan.* plot was sprayed both sides of the fence as well as the *A.bra*. area.

8/02/02 Only isolated plants of both species, with no *A.pan* sighted N of new fence line. Sprayed for both plots.

Site: ***Oxford Downs*** – Legumes for Clay Soils
Property Owner: John & Scotty Stuart
Location: Peak Downs H'way
Nebo Shire
21deg 49.51min S; 148deg 40.87min E

Accessions Planted:
Indigofera schimperii was the only targeted species planted here.

Activities:
These sites (adjacent to COPE) were cultivated and planted to forage sorghum over the 1997-99, inspection and spraying of *Indigofera* had been conducted a few times over the preceding summers.

April 00 Found considerable number of mature and seeding plants in both plots. Hand pulled!

Recommendation (as of Jul 00):
Spray and monitor next summer.

20/12/00 Sprayed about ten mature plants in the old adaptation area while none were seen in the LCS area – expect some would be present but probably due to heavy stand of butterfly pea and weeds none were sighted.

Site: ***Oxford Downs*** – Legumes for Clay Soils
Property Owner: John & Scotty Stuart
Location: Peak Downs H'way
Nebo Shire
21deg 49.51min S; 148deg 40.87min E

Accessions Planted:
Indigofera schimperii was the only targeted species planted here.

Activities:
These sites (adjacent to COPE) were cultivated and planted to forage sorghum over the 1997-99, inspection and spraying of *Indigofera* had been conducted a few times over the preceding summers.

April 00 Found considerable number of mature and seeding plants in both plots. Hand pulled!

Recommendation (as of Jul 00):
Spray and monitor next summer.

20/12/00 Sprayed about ten mature plants in the old adaptation area while none were seen in the LCS area – expect some would be present but probably due to heavy stand of butterfly pea and weeds none were sighted.

Site: ***Lynford***
Property Owner: Rod Leggett
Location: Nebo
deg min S; deg min E

Accessions Planted:
Legume Adaptation-:
Aeschynomene americana, A. brasiliana, A. histrix, A. villosa
Chamaecrista rotundifolia
Desmantuhs virgatus
Stylosanthes hamata, S. scabra,

Activities:
Inspections in previous seasons have show presence in fairly high numbers.

Recommendation (as of Jul 00):
The cooperator is not concerned with the presence A. brasiliana and there does not appear to be movement away form the plots. Continue monitoring the situation.

Site: ***Goorganga***
Property Owner: Ralf Cox
Location: 8 km south ofProserpine
deg min S; deg min E

Accessions Planted:

Legume adaptation-:
Aeschynomene americana, A. brasiliana, A. elegans, A. falcata, A. histrix, A.paniculata, A. villosa
Macroptilium atropurpureum

Recommendation (as of Jul 00):
Inspect site and if required consult with the cooperator regarding his needs for eradication or not.

Site: Crediton
Property Owner: Doug Markey
Location: Crediton, Eungella
deg min S; deg min E

Accessions Planted:
Aeschynomene americana
Aeschynomene brasiliana
Asechynomene elegans
Aeschynomene villosa
Arachis pintoi

Recommendation (as of Jul 00):
No target species seen with site over-run with kikuyu. Cease monitoring.

Site: *Eungy*
Property Owner: Chris Kemp
Location: Valkyrie Access Road
deg min S; deg min E

Accessions Planted:
Legume adaptation-:
Aeschynomene americana
Aeschynomene brasiliana
Aeschynomene elegans
Aeschynomene histrix
Aeschynomene paniculata
Aeschynomene villosa
Chamaecrista rotundifolia
Stylosanthes hamata, S. scabra

4/5/88 Very few target plants seen - generally were very small lacking vigour.

5/10/89 No target species sighted.

Recommendation (as of Jul 00):
A visit in the coming summer to confirm absence of target species.

Site: *"Glen Gough"*
Property Owner: Glen Gough
Location: Proserpine (h'wy 15 (?) km nth)
deg min S; deg min E

Accessions Planted:
Aeschynomene americana
Aeschynomene brasiliana
Asechynomene elegans

Aeschynomene filosa
Aeschynomene histrix
Aeschynomene paniculata
Aeschynomene villosa

Recommendation (as of Jul 00):
Site now under sugar cane – no further treatment required.

Site: ***Willunga***
Property Owner: Geoff Bethel
Location: Dingo – Mt Flora Beef Road
Nebo
22 deg 20 min S; 147deg 37min E

Accessions Planted:
COPE-:
Aeschynomene americana, A. brasiliana, A. brevifolia, A. elegans, A. falcata, A. filosa, A. histrix, A. indica, A. paniculata, A. sensitiva, A. villosa
Alysicarpus bupleurfolius, A. longifolius, A. monilifer, A. rugosus, A. vaginalis
Arachis pintoi, A. burkartii, A. correntia, A. pusilla, A. rigonii. A. stenosperma, A. villosa
Centrosema acutifolium, C. brasilianum, C. pascurorum, C. pubescens, C. virginianum
Clitoria ternatea
Lotononis angolensis, L. bainesii, L heterophylla
Chamaecrista biensis, C. biflora, C. falcinella, C.fasiculata, C. mimosoides, C. pilosa, C. rotundifolia
Cyamopsis. senegalensis
Desmantuhs brevipes, D. covellii, D. fruticosa, D. illionenis, D. sublatus, D. virgatus
Desmodium adscendum, D. canum, D. heterophyllum, D. heterocarpon
Dolichos trilobus
Indigofera schimpri
Lablab purpureus
Macroptilium atropurpureum, M. gibbosifolium, M. gracille, M. lathyroides, M. longipedunculatum, M.psammoides
Macroptyloma africanum, M. axillare, M. datonii, M. maranguensis, M uniflorum
Medicago sativa
Rhynchosia aurea. R. balansae, R. candida, R. caribaea, R. cyanosperma, R. densiflora, R. hirta, R. micrantha, R. minima, R. oblatifoliata, R. schimperii, R. sublobata, R. totta, R. verdcourtii, Stylosanthes, S. scabra
Teramnus labialis, T. repens, T.uncinatus
Vigna decipiens. V. gracille, V. luteola, V. oblongifolia, V. parviflora, V. schimperii, V. trilobata, V. ungiculata, V. vexillata

BULS-:

Aeschynomene americana	*Glenn;Lee;*56282;91235;93624;93661
Aeschynomene brasiliana	92519;93592
Aeschynomene falcata	*Bargoo*
Aeschynomene histrix	93593;93636;93638
Aeschynomene villosa	37235;91209;93621
Alysicarpus monilifer	52343;
Alysicarpus rugosus	51655;69487

Atylosia sericea	30042
Chaemaecrista pilosa	57503;Col's (57503)
Chamaecrista rotundifolia	*Wynn;*85836;86172;93094
Desmanthus virgatus	30205;33201;37538;38351;40071;49728;52401;55719;67643;78372; 79653;85178;90754;TQ90;BBAC10;BBAC11;Marc;Bayamo;Uman
Macroptilium atropurpureum	*Aztec;*84989
Macroptilium axillare	*Archer;*52469
Stylosanthes hamata	*Verano;Amiga*
Stylosanthes scabra	*Seca;Siran*

Recommendation (as of Jul 00):
No target species sighted at previous visits, a final visit this summer to confirm absence.

Site: ***Rolfe Park***
Property Owner: Boyd Bussey (Trevor Pharum – Manager)
Location: Middlemount
deg min S; deg min E

Accessions Planted:
LCS - *Indigofera schimperii* was the only targeted species planted here.

Activities:
Two un-recorded sprayings of Indigofera. One using Starane and other Brush-off.

9/12/97 Hand-pulled Indigofera plants

25/11/99 Sprayed Indigofera about ten large plants very few seedlings

22/2/00 Sprayed Indigofera – plants present.still

Recommendation (as of Jul 00):
Continue monitoring for *Indigofera* and spray as required.

20/12/00 Sprayed with boom and gun as required. Plants scattered throughout plot and two spots in the remainder. Plots fairly heavily vegetated with grass and weeds.

Site: ***Gallway Plains, Calliope***
Property Owner:
Location: 30 km SW of Calliope
24 deg 10 min S; 150 deg 57 min E

Accessions Planted:
COPE-:
Aeschynomene americana, A. brasiliana, A. brevifolia, A. elegans, A. falcata, A. filosa, A. histrix, A. indica, A. paniculata, A. sensitiva, A. villosa
Alysicarpus bupleurfolius, A. longifolius, A. monilifer, A. rugosus, A. vaginalis
Arachis pintoi, A. burkartii, A. correntia, A. pusilla, A. rigonii. A. stenosperma, A. villosa
Centrosema acutifolium, C. brasilianum, C. pascurorum, C. pubescens, C. virginianum
Clitoria ternatea
Lotononis angolensis, L. bainesii, L heterophylla

Chamaecrista biensis, C. biflora, C. falcinella, C.fasiculata, C. mimosoides, C. pilosa, C. rotundifolia
Cyamopsis. senegalensis
Desmantuhs brevipes, D. covellii, D. fruticosa, D. illionenis, D. sublatus, D. virgatus
Desmodium adscendum, D. canum, D. heterophyllum, D. heterocarpon
Dolichos trilobus
Indigofera schimpri
Lablab purpureus
Macroptilium atropurpureum, M. gibbosifolium, M. gracille, M. lathyroides, M. longipedunculatum, M.psammoides
Macroptyloma africanum, M. axillare, M. datonii, M. maranguensis, M uniflorum
Medicago sativa
Rhynchosia aurea. R. balansae, R. candida, R. caribaea, R. cyanosperma, R. densiflora, R. hirta, R. micrantha, R. minima, R. oblatifoliata, R. schimperii, R. sublobata, R. totta, R. verdcourtii, Stylosanthes, *S. scabra*
Teramnus labialis, T. repens, T.uncinatus
Vigna decipiens. V. gracille, V. luteola, V. oblongifolia, V. parviflora, V. schimperii, V. trilobata, V. ungiculata, V. vexillata

Target accessions planted – *Aeschynomene brasiliana* CPI 93592, 92519, *Aeschynomene paniculata* CPI Q24804 *Indigofera schimperii* CPI 52621, 69495 & 73608.

Recommendation (as of Jul00):
As targeted species have been observed in previous visits by local project staff, it will be necessary to monitor the situation this coming summer and spray as required.

Activities:

23/11/00 – Site inspection conducted with Len Mikkelsen. Targeted plants found as follows,
Aes bra Q24801 – none sighted
Aes bra CPI 92519 & 93592 – frequent in both reps, sprayed
Aes pan Q24804 – none sighted
Ind sch CPI 16055, 69495 & 73608 – none sighted
Ind sch CPI 52621 Hand pulled about 10 plants in Rep 1 sprayed both Reps.
Area sprayed was several plots larger than the designated plot size. Conditions were fine with very low grass cover due to constant grazing.

03/04/01 No original plants sighted and seedling recruitment could not be confirmed. Areas sprayed as a precaution.

10/01/02 Few plants A.bra sighted in three areas around plots no. 563, 510, and 67/49, these were sprayed. One *Indigofera* plant (plot no.153) found and removed.

10.6 Detailed site management report for Southern Queensland

MOPES 2002 Project Report: NAP3.225 Managing old plant evaluation sites

(Bob Clem, DPI, Gympie)

Report on sites in central and south-east Queensland
for meeting on 24 and 25th June 2002 ARI, Yeerongpilly

Summary

Progress is reported on the removal of legumes at 4 COPE sites, including 1 Browsenet site, a Back-up Legumes for Stylo (BULS) site, an ACIAR leucaena site and 14 Legumes for Clay Soils (LCS) project sites of which 4 are on research stations and 10 are "on farm".

In the COPE sites both *Aeschynomene brasiliana* and *Indigofera schimperi* are targeted as well as *Acacia boliviana* at the Browsenet site. *Aeschynomene brasiliana* was sown in the BULS site and *Indigofera schimperi* at the LCS sites.

Control of legumes at the COPE sites (all on research stations) has progressed well. These are regularly checked and treated and at Brigalow Research Station old areas are now sown to crop. The main difficulty with these sites is the moderate to high soil seed levels resulting from up to 10 years of evaluation when test plants were allowed to seed. At some sites only a few plants established but in most instances they did produce seed at least in some seasons.

Aeschynomene at the BULS site is still present but is not particularly well adapted and does not regenerate in some years.

It is doubtful that any seedlings of the leucaena lines have established at Brian Pastures Research Station and treatment of old plants is continuing.

Control of indigofera at Brigalow and Narayen Research Station should require little further activity other than checking periodically for seedlings but further measures are required at Emerald and Brian Pastures Research Station where either old plants are still present and soil seed levels are likely to be high.

At the 10 "on farm" sites success with the control of indigofera has varied. At 4 sites removal of plants has apparently been successful and no plants have been observed now for some time. At 3 sites either no plants or only a small population of seedlings has been seen but at the 3 other sites populations are greater and soil seed levels are likely to be very high. At 2 sites there has been little spread from the plot areas because of spraying outside the plots to control plants and also because of strong competition from vigorous and well-adapted grasses. However at Rangeview (Theodore) on a downs soil indigofera has been dominant in the pasture and considerable effort is still needed at this site.

1. COPE (Project No: Mba P39.4 MR)

Brigalow Research Station

Landholder:
Department of Primary Industries
Brigalow Research Station
MS 1855
Theodore Q 4719 (Tel 4997 4166)

Plot location:
Latitude: 24^0 49.24' S
Longitude: 149^0 46.18' E

Plots are located in J Block about 3km from the office and adjacent to the main property road.

Project area: The experimental paddock is about 10ha fenced from the main paddock with netting at the time of first sowing in 1988. Strips of 2 to 3 m were cultivated in the buffel grass (*Cenchrus ciliaris*) pasture and sown to the new accessions. The soil is a grey clay (Ug 5.16) with slight gilgai. Surface pH is 8.1 and available P (Bicarb) is 14 ppm.

Sowing: As part of the Coordinated Plant Evaluation (COPE I and II) project a wide range of pasture legumes and grasses were sown at this site in 1988,1989 and 1990 and in 1992,1993 and 1994.

Target species: *Aeschynomene brasiliana* CPI 92519, CPI 93592
Indigofera schimperi CPI 16055, CPI 52621, CPI 69495, CPI 73608

These accessions were sown only in 1988. A single accession of *Cassia biflorus* was also sown in 1988 but was removed early in the first season prior to seed set. There was no further emergence of seedlings recorded.

Progress: *Aeschynomene* accessions established but did not persist into the second season. *Indigofera schimperi* established in small numbers and slowly increased in density in the plot area before treatment was commenced in April 1998. Final project recordings were made in 1998. During the years of experimental measurement and recording, except for the season of establishment, the area was grazed throughout the year by 4 to 5 steers (=stocking rate of 2 ha/steer), which is similar to industry practice. Although not readily grazed in the growing season all plants were heavily grazed during the dry season each year. Stock were restricted to the 10ha area to restrict movement of seed to adjoining paddocks.

All plots were sprayed with metsulfuron at 10g/ha on 27 April 1998, 4 November 1998, 15 March 2000 and 6 September 2001. On 5 August 1999 tebuthiron at 10kg/ha was applied to the old plots.

At the last observation on 6 September 2001 spraying had removed all but a few old plants but seedlings were still present. Pegs were moved to fencelines so that the area could be cultivated but distances recorded so that old plots could be relocated for future checking. The paddock was cultivated in January 2002 and prepared for winter crop planting by several further cultivations. Wheat was planted on 17 April 2002.

Proposed future action: The proposal is to crop the paddock for some years so cultivation and in-crop weed control will remove seedlings that emerge. Over the cropping cycle there should be little need for any further action. If or when the area is resown to pasture the plots should be checked at least once each year, preferably in early summer, for any seedlings.

Brian Pastures Research Station

Landholder:
AgForce (Qld) from April 1990 (formerly Meat Research Corporation)
Brian Pastures Research Station
PO Box 118
Gayndah Q 4625 (Tel 4161 3700)

Location:
Latitude: 25^0 39' S
Longitude: 151^0 45' E

Plots are located in 3 paddocks. COPE I plantings (Granite site) were sown in North Bambling paddock and (Basalt site) in Mt Bambling cultivations. COPE II was sown in Middle paddock.

Project areas: COPE I, Granite site was on a course granite sandy soil (Uc 2.21) and the basalt site was on a weakly self-mulching grey clay (Ug 5.24). The experimental areas of about 2 ha were fenced to exclude stock. Strips of 1m were cultivated in the native pasture and sown to the new accessions. COPE II site was on a brown texture contrast soil (Db 2.23) with surface pH of 5.7 and P (Bicarb) of 9 ppm.

Sowing: As part of the Coordinated Plant Evaluation (COPE I and II) project a wide range of pasture legumes and grasses were sown in COPE I in 1988,1989 and 1990 and in COPE II in 1992,1993 and 1994.

Target species: *Aeschynomene brasiliana* CPI 92519, CPI 93592
Indigofera schimperi CPI 16055, CPI 52621, CPI 69495, CPI 73608

These accessions were sown only in 1988 at the 2 sites. At the granite site only a few legumes established and no *Aeschynomene brasiliana* or *Indigofera schimperi* were present in early 1989. At the basalt site all accessions of *Indigofera schimperi* established and were present at the final recording.

Progress: COPE I, Granite site. The COPE area was cultivated and sown to other grasses in 1994/1995. No indigofera or aeschynomene have been seen at this site during periodic inspections since.

COPE I, Basalt site. This area was cultivated after final observations in 1995 and sown to leucaena. Indigofera plants are still present but the paddock of about 4 ha is checked and seedlings sprayed on a regular basis.

Proposed future action: COPE I, Granite site. No further action necessary.

COPE I, Basalt site. The paddock will continue to be checked and seedlings sprayed as necessary. It is recommended that management of this paddock be continued as at present and the paddock be retained. To prevent spread outside the paddock steers grazing it should not be given access to other areas.

2. COPE (Browsenet)

Brian Pastures Research Station

Landholder:
AgForce (Qld) from April 1990 (formerly Meat Research Corporation)
Brian Pastures Research Station
PO Box 118
Gayndah Q 4625 (Tel 4161 3700)

Location:
Latitude: 25^0 39' S
Longitude: 151^0 45' E

Project areas: Trees and shrubs were planted in February 1990 in a small fenced paddock on brown solodic soil at Brian Pastures Research Station.

Target species: *Acacia angustissima* CPI 40175, 51651, 57959 and CPI 84971
Acacia spp CPI 75981 and CPI 75982

In May 1992 all lines rated highly for growth in comparison with other lines. They had grown to 3 m and seedlings were recorded for all lines. Steers given access browsed all lines with *A. boliviana* CPI 51651 and 84971 being more readily eaten. All 6 lines were cut and sprayed in August 1992.

Progress: Since 1992 some plants have regrown from old stumps and some seedlings have established. These have been sprayed as part of the weed control program on the research station with a range of chemicals. Most recently the treatment has been basal bark or overall spraying with ACCESS ^{R} (Triclopyr + picloram). It is highly unlikely that any plants have set seed since 1992 and most recently only isolated new plants have been located.

Proposed future action: Continue to monitor and treat any plants to ensure no seeding occurs.

3. BACK-UP LEGUMES for STYLO (Project DAQ 083)

Brian Pastures Research Station (Ridges block)

Landholder:
Bryant family trust (formerly owned by MRC as part of Brian Pastures RS)
Biggenden Q

Location:
Latitude: 25^{0} 45' S
Longitude: 151^{0} 46' E

Project areas: Plots were sown in December 1992, December 1993 and in January 1995. Areas were fenced and monitored to 30 June 1999. Soils were sandy surfaced but varied (Uc 2.22 and Dd 1.43) across the site.

Target species: *Aeschynomene brasiliana* CPI 92519, CPI 93592 sown December 1992 and *Aeschynomene brasiliana* CPI 92519 sown January 1995.

Both accessions of *A. brasiliana* established but re-establishment has been sporadic and seedlings have only been seen following favourable rainfall events.

Progress: The paddocks have been checked for the presence of joint vetch and plot areas have been sprayed when seedlings were present. The new owners of the property have been advised of the presence of the plots.

Proposed future action: Suggested that the current land-owner and manager, Brian Pastures RS regularly consult and DPI undertake spraying as necessary.

4. ACIAR Leucaena Project

Brian Pastures Research Station

Landholder:
AgForce (Qld) from April 1990 (formerly Meat Research Corporation)
Brian Pastures Research Station
PO Box 118
Gayndah Q 4625 (Tel 4161 3700)

Location:
Latitude: 25^{0} 39' S
Longitude: 151^{0} 45' E

Project area: Some 25 lines of *Leucaena* species and hybrids were planted in 1996 in a fully fenced area adjacent to other leucaena plantings. Plots were 10 plants per 5m of row x 3 replications plus guard rows of Tarramba leucaena

Target species: All non-commercial lines of leucaena.

During the experimental phase to December 1999 the site was securely enclosed and no stock were given access.

Progress: All plants were cut at or near ground level when the project was finalised. Since that time sock have been given access to graze regrowth prior to any seeding. The site is regularly monitored. Many plants have died and no seedlings of unreleased accessions have ever been recorded either inside or outside of the enclosed area.

Proposed future action: Continue to manage as above to prevent seeding and propose that any live plants be chemically treated.

5. LEGUMES for CLAY SOILS (Project DAQ 086 and NAP3.103)

(i) Legume evaluation in small swards

Brigalow Research Station

Landholder:
Department of Primary Industries
Brigalow Research Station
MS 1855
Theodore Q 4719 (Tel 4997 4166)

Plot Location:
Latitude: 24^0 49.24' S
Longitude: 149^0 46.18' E

Plots are located in J Block about 3km from the office and adjacent to the main property road.

Project area: Small plots of 5x5m were sown into areas of buffel grass (*Cenchrus ciliaris*) pasture cultivated prior to sowing in 1993, 1994, 1995. The soil is a grey clay (Ug 5.16) with slight gilgai. Surface pH is 8.1 and available P (Bicarb) is 14 ppm.

Target species: *Indigofera schimperi* CPI 16055, CPI 52621, CPI 69495 and CPI 73608

Accession 16055 was sown in 1994 and 1995, accession 52621 in 1993 and 1995 and accession 69495 in 1993 and 1994 while 73608 was sown each year. All accessions established but none developed into swards because of strong competition with buffel grass. Animals were given access to the plots each year after recordings were completed and plots were grazed. In comparison with other legumes indigofera was less acceptable to stock although CPI 73608 was generally more readily eaten than the other accessions.

Progress: Plots were sprayed with metsulfuron at 10g/ha on 27 April 1998, 4 November 1998, 15 March 2000 and 6 September 2001. On 5 August 1999 tebuthiron at 10kg/ha was applied.

At the last observation on 6 September 2001 most old plants were dead but a few seedlings were still present. Pegs were moved to fencelines so that the area could be cultivated but distances recorded so that old plots could be relocated for future checking.The paddock was cultivated in January 2002 and prepared for winter crop planting by several further cultivations. Wheat was planted on 17 April 2002.

Proposed future action: The proposal is to crop the paddock for some years so cultivation and in-crop weed control will remove seedlings that emerge. Over the cropping cycle there should be little need for any further action. If or when the area is resown to pasture the plots should be checked at least once each year, preferably in early summer, for any seedlings.

Emerald Research Station

Landholder:
Department of Primary Industries
Emerald Field Station
LMB 6
Emerald Q 4720 (Tel 4983 7426)

Plot location:
Latitude: 23^0 34' S
Longitude: 148^0 11' E

Plots located on area of native pasture at southern end of the research station.

Project area: Small plots of 5x5m were sown into areas of native pasture cultivated prior to sowing in 1993, 1994, 1995. The soil is a black earth (Ug 5.12) with surface pH of 7.3 and available P (Bicarb) of 8 ppm.

Target species: *Indigofera schimperi* CPI 16055, CPI 52621, CPI 69495 and CPI 73608

Accession 16055 was sown in 1994 and 1995, accession 52621 in 1993 and 1995 and accession 69495 in 1993 and 1994 while 73608 was sown each year. All accessions established and some developed into legume dominant swards by the end of the experimental period. The area was never grazed.

Progress: Plots were sprayed with metsulfuron at 10g/ha on 1 May 1998. They were burnt in the spring of 1999 but at last visit on 23 January 2001 many seedlings were found in most plots.

Proposed future action: Liase with Research Station manager to continue treatment that is compatible with proposed future use of the area.

Narayen Research Station

Landholder:
Department of Natural Resources and Mines (formerly occupied by CSIRO)
"Narayen"
via Mundubbera Q 4626 (Tel)

Plot location:
Latitude: 27^0 21' S
Longitude: 152^0 53' E

Plots located on old cropping area on brigalow side of property.

Project area: Small plots of 5x5m were sown into areas cultivated prior to sowing in 1993, 1994, 1995. The soil is a cracking clay (Gn 3.13) with surface pH of 6.5 and available P (Bicarb) of 62 ppm.

Target species: *Indigofera schimperi* CPI 16055, 52621, 69495 and 73608

Accession 16055 was sown in 1994 and 1995, accession 52621 in 1993 and 1995 and accession 69495 in 1993 and 1994 while 73608 was sown each year. All accessions established and some developed into legume-dominant swards by the end of the experimental period.

Progress: Plots were sprayed with a range of chemicals over the period 1998 to 2000 and at last report no indigofera was present.

Proposed future action: Suggest periodic checking for seedlings.

Brian Pastures Research Station

Landholder:
AgForce (Qld) from April 1990 (formerly Meat Research Corporation)
Brian Pastures Research Station
PO Box 118
Gayndah Q 4625 (Tel 4161 3700)

Location:
Latitude: 25^0 39' S
Longitude: 151^0 45' E

Project area: In January 1996 2 paddocks of 3.2ha were sown to *Indigofera schimperi,* Katambora Rhodes grass *(Chloris gayana* cv. Katambora) and Queensland bluegrass *(Dichanthium sericeum)* as part of a legume grazing trial. Paddocks were stocked with 2 weaner steers (1.6ha/steer) from 19 February 1998. In June 1999 animals were removed as the pasture had become legume dominant and steer liveweight performance was lower than the control treatment. A program to remove the legume from the paddocks was commenced.

Target species: *Indigofera schimperi* CPI 16055, CPI 52621, CPI 65477, CPI 69495, CPI 73608 and CPI 96972

Progress: Paddocks were slashed after animals were removed in June 1999. They were then sprayed with metsulfuron at 10g/ha on 7 October 1999 and with glyphosate at 3L/ha on 8th March 2000. The paddock were then cultivated and sown to oats on 15 June 2000. Following grazing of the oats the paddocks were sprayed with glyphosate on 15 November 2000 and on 26 February 2001and with metsulfuron at 10g/ha plus dicamba at 750ml/ha on 24 April 2001. Oats was again sown in 2001 and when grazing was finished indigofera seedlings were sprayed with glyphosate at 2L/ha on 19 December 2001. Paddocks were then cultivated and prepared for oats, which was planted on 19 June2002.

Proposed future action: Paddocks will be used for annual winter forage cropping and indigofera seedlings removed by spraying or cultivation.

(ii) "On farm" demonstrations of pasture and ley legumes

Kookaburra (Wandoan)

Landholder:
Mr Leo Bahnisch
"Mt Moore"
Gulugaba Q 4418 (Tel 4628 3328)

Location:
Latitude: 25^0 55' S
Longitude: 149^0 47' E

Project area: Some 20 legumes were sown with and without Bambatsi panic (*Panicum coloratum*) in 2 replicates in 12x5m plots. Soil type is a black earth (Ug 5.16) with surface pH of 8.0 and available P (bicarb) of 6 ppm. Legumes were sown into cultivated soil in 1994. Persistence and growth were monitored until 1998 and plots were periodically grazed over this time and subsequently. Indigofera was readily eaten at this site.

Target species: *Indigofera schimperi* CPI 69495

Progress: All indigofera outside the plot area was sprayed with metsulfuron at 10g/ha on 4 June 1998, 4 November 1998 and 6th September 2001. On 6 August 1999 tebuthiron at 10kg/ha was applied to large plants and on 14 January 2002 the plots were sprayed with fluroxypyr at 750ml/ha

plus dicamba at 750ml/ha. This spraying was very effective as observed when the site was revisited on 30 January2002.

Proposed future action: Follow-up treatment will be needed in the short term to remove missed plants and in the longer term to kill seedlings.

Kapalee (Biloela)

Landholder:
Mr Lindsay Sharpe
"Kapalee"
Biloela Q 4715 (Tel 4995 3140)

Location:
Latitude: 24^0 24' S
Longitude: 150^0 25' E

Project area: Some 20 legumes were sown into cultivated soil in 1994 in 20x10m plots with 2 replicates. Buffel grass (*Cenchrus ciliaris*) was oversown over the legume plots. Soil type is a black earth (Ug 5.16) with surface pH of 8.5 and available P (bicarb) of 15 ppm. Persistence and growth were monitored until 1998 and plots were periodically grazed when stock were grazing crop stubble.

Target species: *Indigofera schimperi* CPI 69495

Progress: Plots were sprayed with metsulfuron at 10g/ha on 30th May 1997, 28 April 1998 and 5 November 1998. The area was then returned to cropping. On subsequent visits on 16 March 2000 a few plants were sprayed but on 24 January 2001no indigofera plants were found.

Proposed future action: No further action required.

Rangeview (Theodore)

Landholder:
Durkin Bros
"Silverton"
Theodore Q 4719 (Tel 4993 1053 (Jim), 4993 1617 (Peter))

Location:
Latitude: 24^0 43' S
Longitude: 150^0 02' E

Project area: Some 20 legumes were sown into cultivated soil in 1994 in 20x10m plots with 2 replicates. Purple pigeon grass (*Setaria incrassata*) was sown over the legume plots at the same time. Soil type is a black earth (Ug 5.12) with surface pH of 7.5 and available P (bicarb) of 7 ppm. Persistence and growth were monitored until 1998 and plots were periodically grazed when stock were grazing crop stubble.

Target species: *Indigofera schimperi* CPI 69495

Progress: Plots were sprayed with metsulfuron at 10g/ha on 30 May 1997, 28 April 1998, 3 November 1998 and 11 December 1998. On 1 April, 14 May and 16 September 1999 glyphosate at 3l/ha was used on scattered old plants and seedlings were sprayed with metsulfuron at 10g/ha on 19 November 1999, 16 March 2000, 24 January 2001 and 7 September 2001. Seedlings were still present when checked on 12 February 2002 but conditions have been dry for spraying.

Proposed future action: Property owners will cultivate the area and use it for cropping but there is a large soil seed load at this site and regular follow-up treatment will be needed to restrict seedling development and reseeding.

Birrong (Rolleston)

Landholder:
Mr Ross Rolfe
"Birrong"
Orion via Springsure Q 4722 (Tel 4984 6162)

Location:
Latitude: 24^0 14' S
Longitude: 148^0 18' E

Project area: Some 20 legumes were sown into cultivated soil in 1994 in 20x10m plots with 2 replicates. Purple pigeon grass (*Setaria incrassata*) was sown over the legume plots at the same time. Soil type is a black earth (Ug 5.12) with surface pH of 7.0 and available P (bicarb) of 50ppm. Persistence and growth were monitored until 1998 and plots were regularly grazed when stock were grazing the paddock.

Target species: *Indigofera schimperi* CPI 69495

Progress: Plots were sprayed with metsulfuron at 10g/ha on 2 June 1998, 18 November 1998 15 March 2000 and 23rd January 2001.

Proposed future action: Periodic checking needed to spray seedlings.

Goondooroo (Springsure)

Landholder:
Mr Hugo Spooner
"Goondooroo"
PO Box 105
Springsure Q 4722 (Tel 4984 1105)

Location:
Latitude: 23^0 49' S
Longitude: 148^0 07' E

Project area: Some 20 legumes were sown into native pasture in 1994 in 20x10m plots with 2 replicates. Soil type is a black earth (Ug 5.12) with surface pH of 7.0 and available P (bicarb) of 55ppm. Legumes failed to establish although a few plants of indigofera did establish.

Target species: *Indigofera schimperi* CPI 69495

Progress: Plots were sprayed with metsulfuron at 10g/ha on 1 May 1998 and on 23 January 2001.

Proposed future action: Periodic checking needed to spray seedlings.

Mutation (Clermont)

Landholder:
Mr Bob Clark
"Mutation"
Clermont Q 4721 (Tel 4983 5160)

Location:
Latitude: 22^0 27' S
Longitude: 147^0 29' E

Project area: Some 20 legumes were sown into cultivated soil in 1994 in 20x10m plots with 2 replicates. Purple pigeon grass (*Setaria incrassata*) and Queensland bluegrass (*Dichanthiun sericeum*) were sown over the legume plots at the same time. Soil type is a black earth (Ug 5.15) with surface pH of 9.0 and available P (bicarb) of 7ppm. Persistence and growth were monitored until 1998 and plots were grazed when stock were grazing crop stubble in the paddock.

Target species: *Indigofera schimperi* CPI 69495

Progress: Plots were treated with tebuthiron at 10kg/ha in February 1996. This was very effective but a few plants mainly on the edges of the plots were sprayed with metsulfuron at 10g/ha on 22 January 2001.

Proposed future action: Periodic checking needed to spray seedlings.

Ellenvale (Chinchilla)

Landholder:
Mr Steven Page
"Ellenvale"
Chances Plain via Chinchilla Q (Tel 4668 9103)

Location:
Latitude: 26^0 44' S
Longitude: 144^0 21' E

Project area: Some 20 legumes were sown into cultivated soil in 1995 in 20x10m plots with 2 replicates. Queensland bluegrass (*Dichanthiun sericeum*) was sown over the legume plots at the same time. Soil type is a black earth (Ug 5.24) with surface pH of 7.9 and available P (bicarb) of 40ppm. Establishment and growth of indigofera was poor. Persistence and growth of other legumes were monitored until 1998 and plots were grazed by stock when given access to the small paddock planted to a range of pastures.

Target species: *Indigofera schimperi* CPI 52621

Progress: Plots were sprayed with metsulfuron at 10g/ha on 4 June 1998 and on 10 December 1998 when only 2 plants were found. On follow-up visits on a number of occasions no plants have been seen.

Proposed future action: No further action required.

Bindaroo (Roma)

Landholder:
Mr John Nolan
"Bindaroo"
Roma Q 4455 (Tel 4626 8374)

Location:
Latitude: 26^0 40' S
Longitude: 129^0 02' E

Project area: Some 20 legumes were sown into cultivated soil in 1995 in 20x10m plots with 2 replicates. Queensland bluegrass (*Dichanthiun sericeum*) was sown over the legume plots at the same time. Soil type is a black earth (Ug 5.15) with surface pH of 8.4 and available P (bicarb) of 35ppm. Legumes established in moderate numbers and produced well in year 1 but did not persist well.

Target species: *Indigofera schimperi* CPI 52621

Progress: Only a few plants were present on 13 February 1997 and these were sprayed with metsulfuron at 10g/ha. No plants were found on subsequent visits.

Proposed future action: No further action required.

Kiamanna (Arcadia Valley)

Landholder:
Mr Carl Winter
"Kiamanna"
Arcadia Q 4819 (Tel 4626 7137)

Location:
Latitude: 24^0 31' S
Longitude: 148^0 50' E

Project area: Some 20 legumes were sown into cultivated soil in 1995 in 20x10m plots with 2 replicates. Queensland bluegrass (*Dichanthiun sericeum*) was sown over the legume plots at the same time. Soil type is a black earth (Ug 5.15) with surface pH of 8.5 and available P (bicarb) of 68ppm.

Target species: *Indigofera schimperi* CPI 52621

Progress: Some 20 plants in each plot were sprayed with metsulfuron at 10g/ha on 3 June 1998 and odd plants were again sprayed on 9 December 1998. No plants were found on subsequent visits.

Proposed future action: No further action required.

Carramah (Capella)

Landholder:
Mr Gil Fairweather
"Carramah"
Capella Q 4702 (Tel 4984 9565)

Location:
Latitude: 22^0 52' S
Longitude: 147^0 54' E

Project area: Some 20 legumes were sown into cultivated soil in 1995 in 20x10m plots with 2 replicates. Queensland bluegrass (*Dichanthiun sericeum*) was sown over the legume plots at the same time. Soil type is a black earth (Ug 5.12) with surface pH of 8.5 and available P (bicarb) of 25ppm. All legumes and grass established successfully and performance was monitored to 1998. Plots were not grazed.

Target species: *Indigofera schimperi* CPI 52621

Progress: On 30 April 1998 plots were sprayed with metsulfuron at 10g/ha. The area was cultivated and returned to cropping with a crop of sunflower sown in February 1999. No plants were found on subsequent visits the most recent being 23 January 2001.

Proposed future action: No further action required.

6. WRDC legume plots at Grosmont, Wandoan

Landholder:
Mr Rob Frazer

Project area: A range of legumes were sown in 1993 and 1994 and oversown with purple pigeon grass (*Setaria incrassata*) or buffel grass (*Cenchrus ciliaris*). Plots are still clearly marked.

Target species: *Indigofera schimperi* CPI 16055, CPI 52621, CPI 69495 and CPI 73608.

Progress: Plots have been treated by CSIRO staff previously and were inspected on 14th January 2002. Some 20 old plants were treated with 10kg/ha tebuthiron and about 50 seedlings were sprayed with fluroxypyr at 750ml/ha plus dicamba at 750ml/ha.

Proposed future action: Periodic checking for seedlings.

10.7 DRAFT "MOPES 2" project proposal

Title: Protecting North Australian Grasslands from Rejected Forage Plants of High Weed Potential

Acronyms:

AFFA	Agriculture, Fisheries and Forestry - Australia
AWC	Australian Weeds Council
BRS	Bureau of Rural Sciences
BULS	Back-up Legumes for Stylos
COPE	Coordinated Plant Evaluation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSLG	CSIRO Shrub Legumes under Grazing
CRCWMS	Cooperative Research Centre for Weed Management Systems
DPI	Queensland Department of Primary Industries
JCU	James Cook University
LCS	Legumes for Clay Soils
MLA	Meat and Livestock Australia
MOPES	Management of Old Pasture Evaluation Sites
MRC	Meat Research Council
NAPPEC	North Australian Pasture Plant Evaluation Committee
NRM	Department of Natural Resources and Mines
NSWDOA	New South Wales Department of Agriculture
NTDPIF	Northern Territory Department of Primary Industry and Fisheries.
QHPLC	Queensland Herbage Plant Liaison Committee
SWEEP	Strategic Weed Eradication and Education Program.
UQ	University of Queensland

Project specifications and benefits

Industry Issue

Sown pastures are an essential component of coastal and sub-coastal grazing production systems in northern Australia. They contribute to sustainability by enabling farmers to cost-effectively achieve desired growth patterns while using minimal water and fertiliser application and providing a stable, erosion-minimising ground cover. Many cultivars have been developed, principally by State and Federal government agencies, and are currently being used successfully in sustainable grazing production systems.

All due care was taken by DPI and CSIRO to minimise the risk of evaluating plants with the potential to become weeds of primary production systems or environmental contaminants. Never-the-less a few of the legumes on trial sites throughout Queensland, in short-term projects supported by the Beef Industry (COPE, BULS, LCS, Browse-net and CSLG), have now been identified as a potential weed threat. The MLA-funded and DPI-led MOPES project was conducted between June 1999 and June 2002. This project documented the status of all plants evaluated in the previous project with particular emphasis on those considered to be of a long-term threat to primary production systems or an environmental contaminant. These plants were treated to prevent seeding and reduce seedling and populations and spread monitored and documented. At the completion of MOPES *Acacia angustissima*, *Acacia boliviana*, *Aeschynomene paniculata*, *Indigofera schimperi* and *Aeschynomene brasiliana* (in decreasing order of weed threat) were identified as a threat to northern Australia and a priority for eradication or control. *Aeschynomene paniculata* is also likely to be placed on an AWC list of nine priority weeds for eradication because of the risk to primary production in northern Australia.

The target legumes are well geo-climatically adapted to large areas of northern Australia and have the potential to threaten coastal and sub-coastal grasslands of Queensland, the Northern Territory and Western Australia. All have low to moderate palatability, can form thickets or dense swards and can persist in soil through dormant seed for over ten years.

These plants can be eradicated at most sites through continued suppression of flowering and killing or out-competing seedlings as they germinate. This activity can be continued by DPI pending funding. At other sites this approach will suppress plants but eradication is not likely in the short term because of the high seed load in the soil, the spread of plants outside evaluation areas and release of these plants by other agencies in the past. It is unlikely that DPI will have the resources or funding to continue eradication of the target plants into the long term. However, these plants can be contained in the long term by creating awareness of the potential problem within, and using the channels and clients of, additional stakeholders such as land protection agencies (eg EPA, NRM, AWC), Shire Councils, community groups and land-holders.

Specific objectives

Eliminate the long-term threat of *Acacia angustissima*, *Aeschynomene paniculate, Indigofera schimperi*, and *Aeschynomene. brasiliana* and to the grazing industries and natural heritage of northern Australia through:

- eradicating or suppressing these plants at all known localities through killing mature and seedling plants before they produce viable seed
- involving additional agencies to DPI (eg EPA, NRM, AWC, Shire Councils and community groups) to promote awareness of, and monitor and control the target plants.

A subsidiary objective will be to demonstrate responsible plant evaluation practices with a view to promoting the grazing industries as genuinely sustainable systems of producing live cattle and meat.

Methodology

Eradication or suppression of target plants by DPI

All sites listed in Appendix 1 are considered to be of high priority because they have recently contained plants of the target species and are therefore are a potential source of environmental contamination. DPI officers based at Walkamin, Mackay, Gympie and Gayndah can access, assess and treat most sites within one day, although in some cases it is more efficient to overnight when treating clustered sites more than two hours drive from base or when treating badly contaminated sights of high priority. Batavia Downs (near Weipa) is the worst site because of the number and spread of *Aeschynomene paniculata* plants, high seed loads caused by poor access when treatment is required and distance from a DPI base (one day each way). This site requires approximately ten days treatment per year by either DPI officers alone or with assistance from the resident Station caretaker. Approximately 50 nights accommodation will be sufficient for all staff effectively treat all sites in north (20 nights), central (10) and south-east (20) allowing each site to be visited twice per season.

A visual survey will be conducted at each site to estimate plant populations, growth stage and spatial distribution. At sparsely populated sites individual plants will be counted, whereas at densely populated sites procedures such as transects or Botanals will be used. Sites and plants will be located by GPS and field markers and the information added to a database linked to high resolution maps. At the few sites where plants have been allowed to seed, soil samples will be taken and the collected seed tested for germination potential.

The method used to kill plants will be different at each site because of differences in target plant population and spread, site access, tree coverage and land-holder management priorities.

Effective methods have been developed for each species based mostly around the use of systemic and residual herbicides (Table 2). Application of herbicides will be by hand (Graslan), knapsack, from a quad motorbike fitted with a spray equipment or tractor mounted boom spray depending on the terrain and target plant distribution. In most cases where over-sowing with a vigorous grass was identified as a useful method, the stand has been established in the MOPES project. These stands will be encouraged with fertiliser and using selective herbicides with activity against broadleaved weeds only.

The period of monitoring and treatment will preferably be for three or more seasons beginning in summer 2002. This means that flowering would have been suppressed for at least six seasons at most sites and seed reserves should be exhausted at most sites. Results will be compiled in a technical annual report preferably developed after an annual winter meeting for key DPI project staff and stakeholders (eg NRM and EPA).

Extending weed control strategies beyond DPI

The involvement of effective weed control agencies outside DPI is essential for control of the target species into the long term. The approach will be to use the existing resources, procedures and client bases of land protection agencies operating successfully in northern Australia. At a minimum these are likely to include EPA, NRM, AWC, Shire Councils, universities, Landcare and community groups, the Queensland Herbarium and rural real estate companies in addition to promoting the issue within DPI and CSIRO. Some of these agencies (EPA, NRM, CSIRO, James Cook University and the Queensland Herbarium) have already supported the previous MOPES program and support extension beyond DPI. This approach will allow best information to be used to control these plants from on-the-ground eradication through to policy development. This approach will also encourage stronger ties between all agencies including funding bodies.

The type and form of information developed and supplied will be strongly driven by the needs of the cooperating agencies. Initially the data collected by technical staff will be consolidated in technical aids such as ‘QPASTURES’ and annual technical reports. This material will be reviewed annually to determine priorities and opportunities and to develop a meaningful annual report available for circulation within DPI and to other stakeholders. The process will be designed to involve as many stakeholders as is practicable, with representation from EPA, NRM, CSIRO, James Cook University and the Queensland Herbarium seen as an absolute minimum. The project will also be reviewed as a standard agenda item at NAPPEC meetings, providing excellent opportunity for discussion by stakeholders involved in plant introduction from DPI, CSIRO, EPA, NRM, NSWDOA, NTDPIF, UQ, JCU, the Queensland Herbarium and the seed industry.

The information collected will include: site location including new reports; changes in plant population, distribution and soil seed loads; the types of, and most effective control strategies used at each site; site specific factors which may influence future weed potential (eg proximity to roads or waterways); and changes in ownership and likely future tenure. Photographs, digital images and video footage will be collected for producing extension resources.

In addition to the technical information collected during MOPES and the proposed project, the information reported to the cooperating agencies is likely to include reviews of: botanical and agronomic characteristics of the target plants with emphasis on reproductive strategies; the evaluation procedures previously used on these plants; and current legal policy on the status of the target plants. An updated inventory of influential agencies and staff contacts will also be supplied.

The form of the final information resources produced by DPI will be determined by the priorities of the cooperating agencies. Where possible, the most compatible formats will be used so that the material can be easily incorporated into additional extension systems (eg SWEEP program). It is currently envisaged that the information will be supplied on CD containing the technical

information and reviews specified above plus detailed high resolution maps (plus GPS coordinates), photographic images, video footage of the best practice control methods. Appropriate information will also be supplied to the public in the form of fact sheets available on the DPI web site and press releases.

Although the project is predominately a technical exercise of eradicating or controlling the target species, it provides an excellent opportunity to further review plant evaluation procedures to (1) minimise the risk of this happening again and (2) determine the most effective methods for controlling hard-seeded legumes in extensive grasslands. This information would be of value to policy makers and the scientific community throughout the tropics as the introduction of grasses and legumes into primary systems is an extensively and increasingly used approach to sustainable food production. This will be communicated in the most effective formats (eg articles, technical and scientific papers) and networks. There is also opportunity to use the Fifth International Herbage Seed Conference hosted at Gatton College and Walkamin Research Station during November 2003 to promote the project.

Expected out-puts and benefit to industry

The key measurable outputs will be: the eradication of plants at most evaluation sites and significant reduction of plants and soil seed loads at others; technical information resources in a range of formats suitable for use by other stakeholders targeting sustainable landscape management; complete and current detailed databases available for use by all stakeholders; and strengthened and better coordinated plant evaluation and commercialisation practices. Perhaps the most significant, but less measurable, output will be the establishment of a broad network of land protection agencies aware of the risks of the target plants, control methods and the activities of the other agencies.

The grazing industries, particularly beef production operations in extensive areas of sub-coastal northern Australia, will benefit from the protection of essential feed resources required to service market expectations for meat and live export product. In particular, the threatened grazing area includes the more productive pastures of Queensland. The target species also have the potential to become aggressive environmental contaminants of unstocked grasslands and riparian zones, causing damage to the natural heritage of northern Australia.

In its current form, the Project will greatly reduce the future threat to grazing systems in northern Australia through immediate containment of known threats and engaging greater resources to develop robust plant evaluation procedures and control ‘escapes’. This is an excellent opportunity to demonstrate and publicise the responsible practice of those agencies which previously invested in forage plant evaluation programs. This, and strong collaboration with the other stakeholders involved in this project, will be essential to facilitate the future development of grasses and legumes to support the grazing industries.

Intellectual property

There is considerable opportunity to produce intellectual property within this project. This will likely be owned by DPI and the funding body as is standard contractual practice. However, the overriding intention of this project is to promote the eradication of the target plants and responsible plant evaluation practices compatible with all land-users. It is therefore considered most appropriate to distribute as mush useful information as possible to influential stakeholders and the public.

10.8 Draft code of practice for evaluation of future introduced forage plant cultivars.

The evaluation and release of tropical pasture plants

Prepared by the Northern Australian Pasture Plant Evaluation Committee*

The Vision

Viable grazing industries based on sustainable use of native and sown pasture systems, in harmony with the environment, community values, and the needs of other industries.

Cardinal Principle
To demonstrate “due care” by taking all reasonable and practicable steps to avoid the release of plants that may have a negative impact on primary production or the environment.

Why a Code of Practice

The Northern Australia Pasture Plant Evaluation Committee has developed this Code of Practice to guide pasture scientists in an ethical and environmentally responsible approach to pasture plant evaluation and release. While adherence to the Code is not obligatory, intentional disregard for the Code is judged harshly by colleagues and the community, and could lead to litigation. Compliance with the Code is a defence in the event of unlawful environmental harm being caused through plant evaluation activities (see Environmental Protection Act 1994).

The need for pasture plant introduction and evaluation

Livestock industries have played, and still play, an important part in maintaining the overall economic stability of northern Australia. The beef industry in Queensland was worth over 1.5 billion dollars per year between 1992-3 and 1996-7 for slaughtered and live export stock. Over the same period, dairying was worth over 290 million dollars per year to the State (OESR http://www.oesr.qld.gov.au/views/statistics/topics/agriculture/agric_fs.htm). These industries are largely dependent on productive and stable pastures. Northern Australia has a vast native pasture resource, which supports over 70% of the beef herd and 95% of the sheep flock of the area. However, in the rapidly changing market oriented supply systems of today, native pastures alone are often not capable of supporting the levels of animal production necessary to meet market demands. Pastures vary in their ability to supply nutrient to animals, and animal performance is related to nutrient supply.

Native grasses generally mature early, with a consequent rapid decline in feed quality, often from the middle of the growing season thus placing a ceiling on levels of animal production attainable over a given season. Further, it has become apparent that many of the native species that have evolved under a regime of moderate marsupial grazing pressure are intolerant of the grazing pressures applied under commercial production conditions. Consequently, large areas of native grassland are in a state of change, with a shift towards less productive, unpalatable species such as *Aristida* spp. and *Imperata cylindrica.* While it is possible in many instances to arrest this decline by reducing stock numbers, this is often not seen as an economically viable alternative by graziers.

It has been well recognised for over a century, that certain exotic grasses and legumes differ from native species, through being more tolerant of grazing, and/or being able to produce higher yields of better quality herbage. These species have also been found to be able to colonise areas where tree communities such as the coastal rainforests, brigalow (*Acacia harpophylla*) and gidgee (*Acacia cambagei*), were cleared for agriculture, leaving no native pasture species of any consequence. Over the years, a range of tropical pasture species has been introduced, largely from Africa and South and Central America, to improve the grazing industries of northern

Australia. A 1996 assessment of the value of these sown pastures in northern Australia suggests that the annual gross benefit to be at least $80 million, assuming all pastures were used for beef production. This figure is probably considerably higher when dairying is included in the equation. The entire dairy herd utilises exotic pasture species and fodder crops almost exclusively.

Collectors have assembled some 17 000 legume and 12 000 grass accessions from Australia and overseas, which are now held at the Australian Tropical Crops and Forages Genetic Resource Centre at DPI, Biloela. Since the 1950s, about 90 cultivars have been released as a result of wild type selection and, to a lesser extent, conventional plant breeding, using the ATFGRC collection as a basic resource in each case. While many of these cultivars are no longer commercially available due to adverse effects of insects and disease, poor seed production, or reduced commercial demand, most have played their part at some stage, in contributing to the level of benefit mentioned above. Intensive pasture plant evaluation over this period has identified those genera and species that can improve sustainability of tropical and sub-tropical farming systems, through improving profitability of the enterprise, and amelioration and protection of the soil. This has been a reductive process, distilling the great diversity among the warm season genotypes down to a limited range of species with economic potential. This follows a similar pattern to the one that evolved in temperate countries centuries earlier, where about six genera of sown forage plants now account for the majority of pasture sowings.

It is clear that native pastures alone can no longer support economically viable intensive livestock industries. Exotic pasture species have a complementary role to that of native pastures in the development of sustainable production systems. Research to date has provided many useful cultivars and developed a considerable database of information. While the demand for new forage varieties has declined, there is a need to maintain evaluation activities, albeit at a lower level, in order to respond to needs of industry as they emerge. Not only do these introduced species play an important role in improving productivity and conserving soil, they can also assist in maintaining natural biodiversity. Judicious use of carefully selected exotic cultivars can relieve the grazing pressure on the less grazing tolerant native pasture plants, thus enhancing their survival.

The Environmental Protection Act 1994

The objective of the Environmental Protection Act 1994 is “to protect Queensland’s environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).”

Environment (section 8) includes:

- ecosystems and their constituent parts, including people and communities,
- all natural and physical resources,
- the qualities and characteristics of locations, places and areas, however large or small, that contribute to their biological diversity and integrity, intrinsic or attributed scientific value or interest, amenity, harmony and sense of community,
- the social, economic, aesthetic and cultural conditions that affect, or are affected by, things mentioned above.

The Act places responsibility on all Queenslanders to meet an environmental duty of care (*general environmental duty*, section 36). This means that “A person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm.” In deciding what constitutes “all reasonable and practicable measures” the person should consider:

- the nature of the harm or potential harm,
- the sensitivity of the receiving environment,

- the current state of technical knowledge for the activity,
- the likelihood of successful application of the different measures that might be taken,
- the financial implications of the different measures as they would relate to the type of activity.

The Act defines *environmental harm* (section 14) as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance. In turn, *environmental value* (section 9) is a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation. The Act also refers to *contamination* of the environment (section 10), this being the release (whether by act or omission) of a contaminant (which may include live organisms) into the environment. An activity may be prescribed by regulation as an environmentally relevant activity if the Governor in Council is satisfied that:

- a contaminant will or may be released into the environment when the activity is carried out
- the release of the contaminant will or may cause environmental harm.

Best practice environmental management (section 18) of an activity is the management of the activity to achieve an ongoing minimisation of the activity's environmental harm through cost-effective measures assessed against the measures currently used nationally and internationally for the activity. To achieve this, the following should be addressed:

- strategic planning by the person carrying out, or proposing to carry out, the activity,
- administrative systems put into effect by the person, including staff training and monitoring and review of the systems,
- public consultations carried out by the person,
- product and process design,
- waste prevention, treatment and disposal.

Under section 219.1 of the Act, the Minister may, by gazette notice, approve codes of practice stating ways of achieving compliance with the general environmental duty for any activity that causes, or is likely to cause, environmental harm. In the event of "unlawful environmental harm" being caused (section 119), it is a defence to prove:

- the harm happened while an activity (that is lawful apart from this Act) was being carried out; and
- the defendant complied with the general environmental duty either by complying with the relevant Code of Practice or in some other way.

The Obligation in Plant Evaluation

Pasture plant evaluators have an obligation, in the first instance, to provide the grazing community with pasture cultivars that meet the needs of livestock farmers and that can be effectively incorporated into sustainable production systems. However, they also have an obligation to others in the community, to ensure the research activities and the products of research do not adversely impact on the rights and values of those people. That is to say that it is not sufficient simply to produce a useful new pasture variety. The range of introduced species used, and the research activity as a whole, must neither pose a threat to the livelihoods of other farmers, nor create a nuisance to others in the community. NAPPEC believes that due care can be taken to minimise the chance of introduced species becoming significant weeds. Evaluators must comply with the terms of the Environmental Protection Act of 1994, and take all reasonable and practicable measures to prevent or minimise the possibility of causing environmental harm or threat to the environment. Under the Act, the responsibility lies with the individual, not with the Organisation.

However, there is also an onus on executive officers of corporations to ensure that their corporations comply with the Act.

Evaluation protocols

There are three broad principles to be considered in designing and conducting experimentation to evaluate forage species:

1. Product quality - New cultivars must have benefit over existing cultivars and meet the needs of the farming community.

2. Environmental weed threat - All reasonable precautions must be taken to avoid environmental harm as defined under the Environmental Protection Act of 1994.

3. Ethical approach - Due care must be exercised to ensure the activity, or the products of the activity, do not adversely impact on the rights and sensibilities of other members of the community. To this end, researchers should pay due attention to the use of responsible and ethical site and stock management, animal welfare issues, and the potential weed threat posed by any introduced plants.

With these principles in mind, there are a number of issues that should be addressed prior to, during, and subsequent to any plant evaluation activity.

- *Weed Risk Assessment*: The biological point of release of a new plant is when it is introduced with minimal controls into an environment. It is therefore essential that:
  1) A voucher specimen of all taxa or cultivars to be sent to the Queensland Herbarium for formal identification and registration.
  2) All entries in an evaluation will be subject to the AQIS WRA system.
  3) Entries under evaluation will be grown under closely controlled conditions to resolve doubt.
  4) Entries rejected or under evaluation will not be included in field plantings.
  5) Only entries which pass WRA system to be included in field evaluations.

- *Containment of Introductions*: As an added precaution, it is important to be able to control vegetative spread and spread of propagules of entries from evaluation sites. Siting of plots away from natural drainage lines and use of structures to divert water flow will minimise the chance of movement of seed. Use of small plots facilitate ease of eradication should the need arise. The grazing animal can also move seed, by passing it through the gut, or by attachment to the coat. Sites should therefore be fenced, and grazing managed, to avoid such movement of seed. The area should be monitored for unwanted escapes. See also *Landholder Agreements* below.

- *Palatability*: One of the most serious weediness characteristics of any plant is unpalatability to livestock. Although the WRA should identify and eliminate unpalatable entries from the evaluation, there may still be the chance of an unpalatable entry's not being detected. It is therefore important that evaluation sites be grazed in the early-stage evaluation, and any plant seen to be avoided by stock should be eradicated **immediately**.

- *The Environment*: The researcher should be aware of the provisions of, and his/her responsibilities, obligations and liabilities under the Environmental Protection Act of 1994, and ensure that all plant evaluation activities constitute best practice environmental management.

- *Animal Ethics*: Research involving animals must be approved by the Animal Ethics Committee and be conducted in accordance with the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (September 1997) and the Animal Care and Protection Act 2001.

- *Collaborator awareness*: The collaborating landholder should be made aware of the characteristics of all varieties to be included in the evaluation on his/her property, and given the right to veto those varieties he/she considers inappropriate or doubtful.
- *Landholder Agreements*: An agreement between the researcher and the collaborating landholder should be formulated and signed prior to planting, detailing the responsibilities of both parties. These would include an undertaking from the landholder not to remove seed or other propagating material from the experiment without first consulting the researcher, and, to the best of his/her ability, to provide the desired control of grazing, fire and fertiliser management of the site. On the part of the researcher, these would include an undertaking to abide by the Code of Practice.
- *Monitoring*: The researcher should visit the evaluation site as regularly as is reasonable and practicable to observe the development of any threat. As much as possible, this should be done in the company of the landholder to observe and discuss progress, and to determine appropriate adjustments to management strategy.
- *Weed Eradication:* During the experiment, and for an agreed time post-termination, the researcher must make every reasonable and practicable endeavour to eradicate any variety that he/she or the landholder deems concerning.
- *Post-termination Management*: The researcher must consult with the landholder at termination of the experiment to determine necessary actions beyond those initially agreed.
- *Research integrity*: The researcher must be constantly mindful that all actions at any site reflect on the research community as a whole. It is therefore incumbent on the researcher to maintain the highest standards achievable, including best practice land husbandry.
- *Site Registration*: The researcher will supply site (including latitudes and longitudes) and treatment details of all plantings to be included in a publicly available register maintained as a part of the Q Pastures data base (DPI).
- *Cultivar Release*: New pasture plant varieties can only be released following submission to, and endorsement by the Queensland Herbage Plant Liaison Committee.
- *Weediness Statement*: All submissions to the Queensland Herbage Plant Liaison Committee recommending endorsement of release of an elite plant cultivar must include a statement on the weediness characteristics of that cultivar, together with an appropriately researched method for its control.
- *Organisational Responsibility*: It is the responsibility of organisations undertaking or sponsoring pasture species research to put in place administrative systems that facilitate Best Practice Environmental Management.

* ***The Northern Australian Pasture Plant Evaluation Committee*** *(NAPPEC) is an inter-organisational assembly of scientists with a common interest in all levels of pasture plant introduction, evaluation and development. Originally it comprised only DPI and CSIRO, but membership has gradually extended to other bodies - NSW Agriculture, NT Department of Primary Industry and Fisheries, the University of Queensland, James Cook University, the Environmental Protection Agency (Qld), Natural Resources and Mines (Qld), Department of Agriculture WA and IAC in New Caledonia (formerly CIRAD, the French overseas research agency). NAPPEC also welcomes representation from agribusiness and the rural community at the annual meetings.*

Evaluation diagram