Case studies

Section 4

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The following case studies demonstrate the range of approaches that have been adopted for mesquite management throughout Australia.

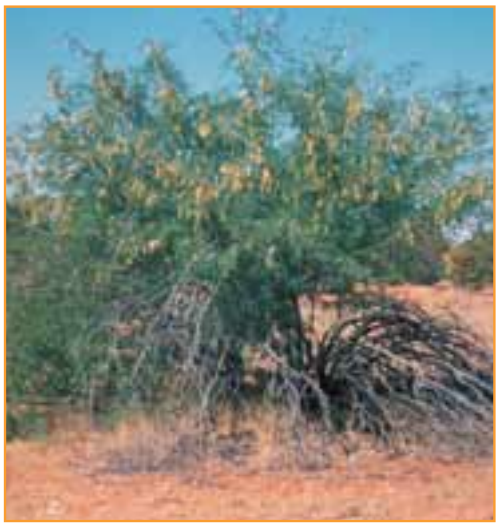
New South Wales

Mesquite in the Broken Hill area

Eric McCormick, Department of Infrastructure, Planning and Natural Resources, Broken Hill

One of the largest mesquite infestations in New South Wales occurs south of Broken Hill on White Leeds Station. *Prosopis* taxonomy remains unresolved. In the past, it was identified as *P. juliflora* by the herbarium in Sydney; however, it has since been reported that at least two species occur in the region —*P. glandulosa* and *P. velutina*.

Mesquite was introduced to the Broken Hill area about 70 years ago for dust abatement, for shade around homesteads and watering places, and for forage. A core infestation along Kellys Creek is currently 8 km long by 200 m wide. Plants range in size and are scattered on both sides of the creek where impenetrable thickets have formed. These have established on previously disturbed areas and range in size up to 4000 square metres.



▲ Previously treated mature and juvenile mesquite, showing the need for long-term follow-up.

The initial infestation was first treated by basal bark spraying in 1970, with all mature plants treated by 1974. Above average rainfall between 1974 and 1978 favoured the germination of new seedlings, which were treated by ongoing basal bark spraying. Summer rainfall events of the 1980s favoured germination. Control through a government-funded program continued until 1992, when all known mature plants were treated. At this time, responsibility for control was passed to the owner/occupier/lessee.

During 1993, the lessee of the property mechanically cleared boxthorn and pepper trees on either side of Kellys Creek in an effort to assist with future mesquite control. In 1995, the lessee died and all control work ceased. By 1996, the once-emergent seedlings now stood as mature mesquite up to 2 m high, with an understorey of plants up to 1 m high. Soil disturbance (as a result of the removal of the boxthorn and pepper trees) and favourable rainfall events since 1992 favoured their germination.

In 1998 the current lessee employed a contractor to remove mesquite thickets by pushing (using a Komatsu WA400 front-end loader). After clearing, limited chemical follow-up control was undertaken. The cleared areas then developed into impenetrable thickets.

▼ Dense thicket treated November 2002 with Grazon® 350ml / water 100L plus wetting agent.

▲ Mature mesquite on drainage line.

In December 2002, $40 000 was expended on chemical control (part government and part lessee contributions). Scattered mature plants were treated with diesel/Access® basal bark application and dense thickets were treated with an overall spray application of Grazon DS® mix with a Quik Spray unit mounted on a Toyota Landcruiser.

All scattered plants and thickets either side of Kellys Creek were treated. At the time of treatment, plants were actively growing and an estimated 90% kill was achieved. Any plants that were missed in the initial spraying, or that had survived, were treated in follow-up procedures in March 2003. The long-term follow-up program is now extremely important. On more than one occasion the same infestation has been treated and the lack of follow-up has seen the infestation return to the same levels prior to any control taking place. Chemical control of emerging plants will be conducted on an annual basis. Continued surveillance and control of areas outside the core area are in place to prevent spread and reinfestation.

Northern Territory

Mesquite on the Barkly Tableland

Jon Peart, Department of Infrastructure, Planning and Environment, Tennant Creek

The predominant species of mesquite found on the Barkly Tableland, Northern Territory, is *P. pallida*. The first recorded presence of mesquite on the Barkly was in 1961. In 2003, of the 12 original infestations, only six remain. Two major infestations occur at Alroy Downs and Lake Nash; the remainder are either single plants or small clumps.

Mesquite was originally introduced for shade and fodder around bores and waterholes, and has remained reasonably confined to these areas. The infestation on Alroy Downs occurs on the Playford River at the homestead. Chemical and mechanical control practices, carried out over the past 10 years, have significantly reduced the size of the infestations. I remember travelling along the Tableland Highway, past the Alroy homestead in the late 1980s and only being able to see the house water-tank up on its tank-stand.

During 2001–02, a station dozer pushed over large, mature mesquite trees along the river. In December 2002, a larger bulldozer was contracted to complete the removal of any remaining trees. In 2003, as a result of the control measures, only four or five juvenile plants can be seen.

Control of any plants germinating following the wet season is yet to be carried out. The control methods used on Alroy can be said to have been successful. The most effective control measures to date have been mechanical and chemical (basal bark spraying). In some areas, access to the trunks for basal bark spraying has been difficult. When mature trees are pushed over, it is easy to gain access to the newly germinated or remaining plants.

The Northern Territory Government, in conjunction with CSIRO (Brisbane), has been involved with the distribution of biological control agents for mesquite in the Territory. The agents released were a leaf-tying moth (*Evippe* spp.) and leaf tip-eating

psyllids (*Prosopidosylla flava*). The first release of the biological agents into the Territory occurred at Alroy Downs, Austral Downs and Lake Nash in May 1998.

There were several releases of the agents over two years, especially of the psyllids. The *Evippe* established at Alroy Downs, but there was no real evidence of psyllid establishment. Forty kilometres from the original release site, at an isolated mesquite infestation, the *Evippe* is still much in evidence. Here, all the mature trees had approximately 70% of their leaves tied and all seedlings to 1.5 m had over 90% of their leaves tied.

Continued on-ground control using the basal bark method is being carried out at the infestation on Alroy. An investigation is pending on the site at Lake Nash to determine the value of pushing over the existing mature trees and spraying the plants that subsequently emerge. For major infestations, CSIRO has advised that mechanical and basal bark spraying control options be used in conjunction with biological agents.

▲ Result of basal bark spraying near waterhole.

In 2002, funding was made available through the Commonwealth Government in the form of WONS (Weeds of National Significance) monies. An amount of $40 000 was allocated to the Barkly region for the eradication of mesquite. Control programs in the region were accelerated as a result. One can see the advantages gained through eradication of mesquite, particularly at the Alroy and Rockhampton Downs infestations and throughout the entire Northern Territory.

▶ Results of mechanical treatment of mature mesquite.

Queensland

Bulloo River flood plain mesquite control project

Robert Cobon, Department of Natural Resources and Mines, Charleville

Background

The infestation of Quilpie mesquite (*P. velutina*) originated from a couple of shade trees planted around the homestead of Comongin Station, north of Quilpie, Queensland, in the 1930s. Following significant rainfall events in the 1950s, mesquite spread to an adjacent lake and has since spread throughout the Bulloo catchment.

The core infestation now consists of 4000 ha of dense mesquite located north of Quilpie, on Como, Comongin and Wanko stations. The remaining scattered infestation covers an area of 300 000 ha, extending from 30 km north of Quilpie to Toompine in the south.

Quilpie is located on the banks of the Bulloo River in south-west Queensland. The Bulloo catchment ends at the Bulloo Lakes on the New South Wales border. The Bulloo River flood plain country is at immediate threat of mesquite invasion, as soil moisture has a major influence on distribution. The Bulloo Lakes, a permanent water source, support a diverse range of flora and fauna including extensive bird populations.

As a result of spread by livestock and machinery, small isolated infestations have been located and subsequently treated on the adjoining catchments of Murray–Darling and Lake Eyre.

SWEEP team carrying out foliar spraying of regrowth.

Control

Since the 1970s, ongoing chemical and mechanical trials have been conducted to identify suitable herbicides and methods of control. The highly adaptive features of *P. velutina* have created challenges in finding best practice control.

Mechanical control was found to be effective for the initial control of medium to dense infestations. It consisted of either blade ploughing light, sandy soils, or stick raking to remove treated plants and regrowth.

Large areas of dense mesquite were initially treated by chemical means during the Strategic Weeds Eradication and Education Program (SWEEP), which was very successful with a greater than 90% kill. However, when it was necessary to treat the regrowth, access through the areas of dead mesquite was a problem. To overcome this, a boom on a dozer blade or stick rake, followed by fire, was used to open these areas up.

Fire has been an important tool in gaining access to treated areas. Fire will rarely kill *P. velutina* (because of limited fuel loads and subsequent low heat), but is valuable as it can delay regrowth. Sufficient fuel loads, however, are often a problem because of mesquite competitiveness, dry conditions and total grazing pressure (domestic, feral and native animals).

▲ Result of blade ploughing.

The following sequence was found to be very effective. Initially, mesquite was treated mechanically (by blade ploughing then stick raking). This was followed by fire to clean up dead matter. Chemical control was then used on regrowth less than 1.5 m in height (foliar spray using Quik Spray units and Grazon DS® at 1:285 plus wetter 1–2 mL/L).

On Quilpie mesquite, basal bark spraying as a chemical method of control has stood the test of time. Although labour-intensive at high densities, it is a cost-effective method for scattered to medium infestations, with kill rates of greater than 95%.

Another method that was used was the excavator slash breaker. While being very expensive, it did achieve a mortality rate of greater than 40%. In 1996–97, suitable rain was received after control using this method, with approximately 50%

stump regrowth and mass seedling germination. Therefore, a low level of control can be achieved by cutting mesquite above the lateral node and this must be assessed against the efficiencies of time saving and cheaper mechanical requirements (e.g. stick rake with cutter bar attachment).

Of the four biological control agents released, the leaf-tying moth, *Evippe* spp., is the most visible. Populations of this moth have increased and readily spread following its release in October 1998. Monitoring has identified groups of mesquite trees with up to 100% of the leaves tied—mainly during autumn and early summer. Although difficult to quantify, such plant stress must reduce plant growth, seed production, and increase mesquite susceptibility to fire.

Conclusion

From 1980 to 2002, the Queensland Government has allocated $3 million to mesquite control in south-west Queensland. The current WONS project (June 2002–December 2003) will invest a further $350 000 from all stakeholders including $150 000 from National Weeds Program (NWP) funding.

Stakeholder partnerships between Quilpie Shire Council, landholders, community and Natural Resources and Mines have developed to foster local management of the project. This will increase control efficiencies while providing additional resources for Quilpie Shire.

The horse paddock on Comongin was solid mesquite prior to blade ploughing in 1990. In 13 years this paddock has been treated nine times, with germination still occurring. It is estimated this work has cost $1500/ha. Of the 4000 ha core infestation, 500 ha remains as original infestation.

Unfortunately, throughout the community, there is still a lack of understanding about mesquite, and hence poor implementation of preventative control measures and its

▸ Biological control release of *Evippe* spp. and *Prosopidosylla flava*—agents received from CSIRO.

▸ Before treatment. Photo October 1998.

importance in long-term sustainable land management. Principles such as property quarantine, control of seed vectors, containment by fencing, livestock management, and weed control incorporated into daily management will dramatically reduce the burden placed on future generations.

With little extra commitment, scattered or isolated mesquite control can be incorporated into daily/weekly management duties. Water runs, aerial and ground mustering, and fence checks (including weed monitoring and control) allow for cost-effective control that is highly strategic in reducing workloads in the future.

The landowner of Greenmulla Station south-east of Quilpie has adopted this approach and fitted farm motorbikes with large garden shears and herbicide. Whenever isolated mesquite is seen in the course of daily or weekly activities, it is immediately cut stumped. This type of commitment demonstrates the level required by all landholders if scattered infestations are to be eradicated in the shire.

▸ After integrated control combination of chemical, mechanical and biological methods. Photo May 2003.

Using fire as a management tool for the control of mesquite

Shane Campbell, Department of Natural Resources and Mines, Charters Towers

Fire can be an effective management tool in the control of some mesquite species, as trials in north-west Queensland have shown. *P. pallida* is very susceptible to fire and burning has dramatically decreased the overall density of the infestation within the research site. Three months after burning, only 8% of the original plants remained alive, compared to 100% tree survival in unburnt areas.

Burning has also reduced the seedling regrowth in subsequent years by destroying a portion of the seeds in the seed bank and by killing most of the large reproductive trees that would have been replenishing the seed bank. However, it was noted that *P. pallida* seedlings that did emerge in burnt areas often grew more quickly as they had less competition once the mature trees were killed.

Hybrid infestations (shrub forms) on Mardie Station in the Pilbara region (WA) have also been shown to be moderately susceptible to fire, at least when fuel loads were high and the fire exceptionally intense. Mortality from a hot fire averaged 88% and no seedlings emerged in burnt areas following favourable rainfall, despite being common in nearby unburnt areas.

All other species of mesquite in Australia appear to be quite tolerant of fire, although no research has been undertaken to determine if an intense fire would have any effect. The general consensus is that some mortality of young plants may occur and the seed bank could be reduced,

Control of *P. pallida* using fire.

but mature plants will generally survive. Nevertheless, even if trees are not completely killed by fire, if the tops are killed, the seed production is reduced for a number of years and woody cover is temporarily reduced. This could assist with other control techniques and increase grass production. When compared with chemical and mechanical treatment, fire is relatively inexpensive. It can also be more easily applied over larger areas provided sufficient resources are available to ensure burning is undertaken safely.

A major constraint in the use of fire is having sufficient fuel loads to carry the fire across an infested paddock. Locking up a paddock and keeping stock away can build up fuel loads. If sufficient fuel is not available to carry a fire across most of the area to be burnt, patchy fires will occur and the number of plants killed will be greatly reduced. For a susceptible species such as *P. pallida*, all attempts should be made to ensure that the initial burn is highly effective. Although closing off a paddock can be an economic loss to landholders, burning of mesquite is a cheaper option than the chemical or mechanical alternatives.

▸ Regrowth of grass 12 months after fire treatment.

▲ Dead *P. pallida* after fire treatment.

One way to increase the fuel load and enhance the effects of fire may be to integrate mechanical control methods. For example, excellent results have been achieved where dense *P. pallida* infestations have been initially chain pulled, left for a period to allow material to dry out and then burnt. Similarly, pushing plants over into windrows and then burning them can be extremely effective, though quite expensive.

It can be concluded that fire does have a role to play in controlling some of the mesquite species present in Australia. How effective it will be will depend on a number of factors, including the species present, timing and intensity of the burn, and size and density of the trees.

Tackling mesquite with barter days

Jim Edwards, Hughenden Landcare Group

The mesquite infestation of *P. pallida* in the Flinders Shire covers approximately 20 000 ha. It is located about 20 km east of Hughenden and stretches roughly 25 km west along the Flinders River and Porcupine Creek. In 1998, the Hughenden Landcare group was formed to address the problem.

▼ Results of basal bark spraying.

The mesquite plant grows in a prickly formation and can grow to 10 m high with a girth of 1 m; it can have 20–30 mm long thorns. The plant prefers loamy or clayey soils in which it can spread very quickly. It can grow in black soil but does not spread as quickly.

Mesquite creates a management problem for the grazier. Because the plant is so prickly, it restricts cattle mustering and can lame horses and cattle with its thorns. In some areas, the trees form impenetrable barriers.

In August 1998, the eight members of the Hughenden Landcare group purchased 60 000 L of dirty diesel from the Hughenden Power Station. Chemical was then mixed with the diesel for basal bark treatment.

The Landcare coordinator at the time suggested that we have barter days. This type of support had been tried by another Landcare group and seemed a good idea to us. A barter day is where the whole group meets on a designated property to spray trees and then rotates until all members' properties have been treated. The group starts early, works till 12 noon, and finishes with a barbeque lunch. The attendance on these days was good and included the eight members plus some town helpers (totalling 12 at times).

▲ Basal bark treatment of mesquite during a barter day.

On good days, over 1000 L diesel/chemical mix was used. Each member chose where they wanted to spray—usually around watering points or laneways. The group has had 30 barter days in total.

The total area the group covered on these days was good, but it became evident later that the basal bark treatment was not 100% effective. This was because some sprayers were not aware of how much spray was required to kill a tree, and were not applying the treatment correctly. However, looking back at the areas treated, about 90–95% of the trees were killed—a good kill rate.

There has been some follow-up in areas where seedlings have come up, but it is thought that foliar spraying would be more efficient than basal bark spraying. The group has not used foliar spraying; however, the Flinders Shire stock routes supervisor has tried this method and found it to be quite effective.

A severe flood affected the Hughenden area in February 2001 and damaged fences and other infrastructure on all the group members' properties. Since then there have not been any barter days but there are plans to meet again in the future.

Mesquite is still a problem in the Flinders Shire. But the barter days have been very successful: we treated mesquite, were encouraged by each other's success and enjoyed the social atmosphere—weed control can often be a very boring and unrewarding type of job.

▶ Hughenden Landcare barter day.

Mesquite on Corfield Downs

Melissa Brien and Peter Klem, Winton Shire Council, in conjunction with Ben and Teena Titley, property managers

Corfield Downs is located 90 km north of Winton and 20 km west of Corfield in central-west Queensland. The property was purchased in mid-2002 to use as a cattle fattening block and is run in conjunction with breeding properties in the Gulf and Middleton. Corfield Downs merged with a neighbouring property, Venture Downs, in 1994. It now covers 45 000 ha of open Mitchell Grass Downs with coolibah-lined creeks and channels, vine tree ridges, some heavy stands of prickly acacia, a few parkinsonia and a number of mesquite trees.

It is believed that mesquite was brought on to Venture Downs in the 1980s by sheep—the main business on the property at the time. The trees had been left as shade trees and are now scattered throughout a 540 ha paddock and around the shearing shed. It is estimated that there are 2.5 mature mesquite trees per hectare with up to 50 small seedlings under each mature tree. Mesquite is now found growing down Waiora Creek, which runs through the main infested paddock, and individual trees have been spotted throughout the surrounding area covering approximately 13 000 ha.

Mesquite on Corfield Downs.

▲ Mesquite can hinder mustering.

Before living on Corfield Downs, we were not aware of the problems mesquite caused, and thought it was merely a shade tree. Since being told by a local rural lands officer of the negative impacts that mesquite can have, we now see it as a pest and are looking at eradicating it from the property. The added assistance of some WONS funding has acted as a catalyst to our taking action in eradicating mesquite.

While we acknowledge it creates dense shade for large numbers of native and domestic animals, the negatives far outweigh the positives. The management difficulties we have experienced from mesquite include reduced pasture production (as no grass grows under mature trees), mustering is difficult, seedlings and thorns spread far from the mature trees, and thorns cause many flat tyres.

Our plan is to control the scattered trees away from the main infestation first. We plan to visit neighbours and observe their eradication programs as we have heard that mesquite can be difficult to kill. We want to do some trials on different methods of control. We are not going to rush into control as we feel that we have some time to eradicate it.

Future plans include using a combination of management strategies, monitoring and more traditional control measures. We will be keeping a photo record of areas before and after treatment. We will map the infestation using GPS for future reference when the trees are gone but the seed bank remains, and we will quarantine stock to prevent further spread. Our goals are not just centred on Corfield Downs; we are located on the top of a watershed and what we do here affects people below. If we eradicate it we will be helping ourselves for the future.

Mesquite seed spread by feral pigs

Ben Lynes, Department of Natural Resources and Mines, Charters Towers

In recent times, concerns have been raised that feral pigs may be dispersing mesquite seed into previously clean areas because, unlike domestic livestock, they cannot be contained by conventional fencing. Through National Weeds Program (Natural Heritage Trust) funding, a research program was started to increase our understanding of the role that feral pigs play in the dispersal of mesquite.

How well and *how far* could feral pigs spread mesquite? In a captive feeding trial, feral pigs were housed in individual pens and fed a known quantity of mesquite (seed or pod) on three separate occasions with their regular diet. The number and condition of mesquite seeds that passed through the gut of feral pigs were recorded, and intact seeds tested for viability in the laboratory. Some interesting things came out…

Seed viability testing showed no difference between boars and sows, or between bare seed and whole pods. Of all the mesquite seed consumed, an average of 14% passed as viable; one dung sample contained 45% of the eaten mesquite seed. Of the passed intact seed, 50% remained viable. The second surprise was how long it took the mesquite seed to pass through the gut of the feral pigs.

Pig housed in individual pen.

The largest proportion of viable mesquite seeds was excreted on day tree (highest rate was 43%). The average time for all viable seed to pass was five days, and the maximum observed time was eight days. Feral pigs could disperse mesquite seed considerable distances following seed ingestion, but how far?

Prior to the peak mesquite podding season, a number of feral pigs were trapped within mesquite infestations in the Hughenden region of north-west Queensland. These individuals had radio tracking devices attached to them and were then released for regular monitoring of their movement patterns during the 2002 dry season.

◂ Feral pig tagged with radio-tracking device.

At the same time, transects or observation points were established among both dense and sparse mesquite to identify how often feral pigs visited infestations to feed. All dung collected along these transects was kept for analysis, as were samples of dung from adjacent clear grazing land during peak pod fall. During the wet or rainy season, observations were made of the number of seedlings emerging from feral pig dung in the field and how many seedlings later survived.

Feral pig activity within mesquite rose as seed pod availability increased, and declined as pod production ceased. Early indications of the radio tracking are that feral pigs spend a great deal of time within mesquite infestations when pods are available, venturing only short distances (several kilometres in radius). Mesquite offers feral pigs shade, security and a source of nutritious food when other foods are scarce. Feral pigs may disperse mesquite large distances; however, their primary role seems to be that of thickening sparse infestations, linking patches, and assisting encroachment or broadening mesquite infestations.

Mesquite seedlings emerging from feral pig manure.

At particular risk of mesquite spread are properties adjoining mesquite infestations, especially if they have water sources that feral pigs may use. In such situations, we have observed in excess of 50 mesquite seedlings emerging from the dung of one feral pig.

Cattle and emu dung has also been collected from the mesquite field site. This dung is in the process of being sieved to determine the presence of intact mesquite seed. The information generated from this research program will help land managers to identify more precisely where mesquite plants could occur, and better understand the relationship between mesquite and dispersal agents such as feral pigs.

Control of mesquite on Yeeda Station

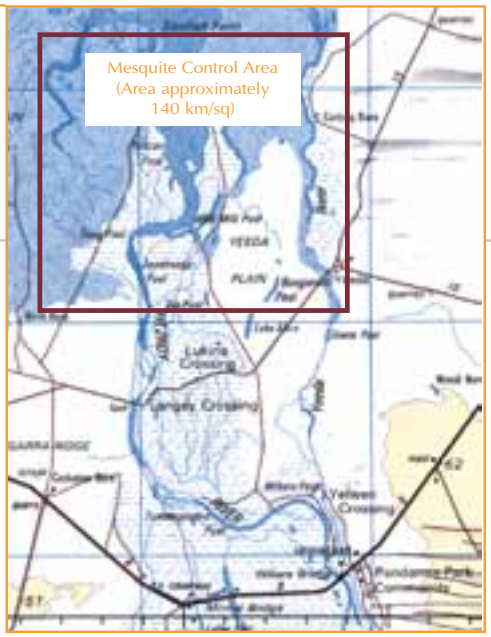
Noel Wilson, Department of Agriculture, Western Australia, Kununurra

It is not known for certain how mesquite was introduced to Yeeda. One possibility is that a station or stations upstream from Yeeda planted mesquite trees for cattle fodder, shade or ornamental purposes and that seed pods from these trees were washed down by the flooding of the Fitzroy River and deposited over the Yeeda flood plains. There is no recorded evidence of old mesquite trees being found around old station homesteads to support this theory, although isolated trees have been found along the Fitzroy River on two other stations.

A more probable explanation is that cattle were imported from a mesquite-infested property in the early 1960s and that these cattle passed out ingested seeds on arrival. New plants were commonly found along stock routes, stock watering points and old marshalling yards—further evidence that cattle were responsible for the spread of mesquite on Yeeda.

Control of mesquite on Yeeda Station first commenced in 1980. Mesquite (*P. pallida*) at this time was confined to the lower reaches of the Fitzroy River; mature trees up to 5 m in height were not uncommon. Reports from the manager of Yeeda Station in 1985 stated that the mesquite was spreading in an easterly direction quite rapidly and had spread along the Yeeda Creek, a tributary of the Fitzroy River.

Inspecting mesquite on Yeeda Station.



▲ Mesquite control area on Yeeda.

Control work from 1980 until 1996 consisted of two to four operators, for about one month, each year, searching the infested area and chemically treating all trees found. The chemical control method employed throughout this time was basal bark spraying using Garlon 600®[1], and then later, Access® mixed with distillate at a ratio of 1:60. This treatment was very successful and is still being used today on trees close to desirable non-target species and along watercourses.

By 1996, the mesquite infestation at Yeeda was well under control, with only 50 to 100 new plants being found annually. The Yeeda infestation mainly consisted of scattered individual trees spread over approximately 140 square kilometres. (This is still the case today). There were isolated thickets of less than one hectare in parts of this infestation.

Helicopter surveillance of the control area is now undertaken annually. This allows the whole area to be searched, and any trees found are treated in less than a day. Some ground surveillance is also carried out, where any trees found are controlled. This is also used as an education session for TAFE students. The number of trees found annually now is under 50. The focus of the control is to find and treat the trees before they start to seed.

Regular monitoring and follow-up control has been beneficial. If regrowth is not treated immediately, seeding trees would cause the infestation to spread and increase in density. As the area is remote, targeted monitoring is necessary to prevent trees seeding and replenishing the seed bank. If this monitoring is not carried out, the infestation could be back to the original infestation size over a period of time.

It is also very important for station staff to be familiar with the plants and control methods so they can treat plants when found.

[1] Garlon 600® is no longer registered for use on mesquite

Pilbara Mesquite Management Committee unites efforts to manage mesquite

Jodi Graham (Pilbara Mesquite Management Committee Project Officer), Karratha
Dr Rieks van Klinken (Research Scientist) CSIRO, Darwin

In the Pilbara region of Western Australia, the planting of 'thornless' varieties of mesquite (*Prosopis* spp.) 70 years ago around the homestead and mills of Mardie Station has resulted in what is now the single largest infestation of mesquite in Australia (about 150 000 ha). At least four species were introduced onto Mardie Station and have since reverted to the thorny wild type and hybridised. So far, hybrid forms have been identified from the species *P. glandulosa*, *P. velutina*, *P. juliflora* and *P. pallida*. The hybrids can grow in tree form but mostly grow in the multi-stemmed shrub form. At Mardie Station, mesquite spread rapidly after cyclonic rain events, with the densest growth occurring along the flood plain tributaries of the Fortescue River. The mesquites grow in the saline mud flats near the coast, in heavy alluvial clay and on bare patches of earth where little else can, or will, grow.

▲ Mardie Station has the largest infestation of mesquite in Australia.

Since 1952, the huge scale of the problem has led to extensive efforts to control the mesquite by costly chemical and mechanical means. However, these control efforts have not succeeded in preventing its spread or recovering any land previously lost to it. In 1998, a biological control agent (a leaf-tying moth called Evippe) was introduced. It rapidly established itself, has resulted in the reduction of foliage

cover by more than 50% and has significantly decreased pod production. Ironically, the success of the defoliating moth could make the application of foliar sprays less effective because of the lack of leaf surface area for the chemical to hit—although this can be overcome by timing applications to coincide with the flushing of mesquite after rains.

In response to previous efforts to control mesquite on Mardie Station, the Pilbara Mesquite Management Committee (PMMC) was formed in April 2000 to identify knowledge gaps in mesquite ecology and control, and to develop a long-term strategy to manage mesquite effectively. The PMMC believes that although eradication is unachievable, it is possible to stop mesquite spreading to neighbouring stations and native reserves in the Pilbara.

Since its inception, the PMMC has been an active and focused group, with participation from a wide range of stakeholders from government, industry and the community. In 2001, the group successfully acquired $250 000 from Natural Heritage Trust funding to employ a project officer to implement the research that will help to produce and implement a strategy for the best practice management of mesquite in the Pilbara. This work is expected to take four years.

In Australia, fire is commonly used for managing woody weeds, as it is cheap and easy to use when treating large areas. Together with biological control, it is the only cost-effective way of managing large infestation such as those in the Pilbara.

However, the hybrid mesquite in the Pilbara is relatively fire resistant and only exceptionally hot fires will cause sufficient mortality. Also, typically low and patchy fuel loads make it difficult to carry hot fires. A trial is therefore currently under way to integrate mechanical control with the strategic use of fire and, in particular, to find the best strategy to optimise fuel loads and conditions to generate fires of sufficient intensity to kill fire-tolerant mesquite. This trial will determine whether pushing and pulling the mesquite over with dozers and chains can increase and spread the fuel sufficiently to carry an intense fire. If the fire is hot enough and able to burn mesquite at a broadscale level, resprouting from the rootstock and seed germination should be minimal.

Containment of the core infestation is a key aim. Containment lines for mesquite on Mardie Station were initially those that fell within 2 km of the neighbouring boundaries. The PMMC aims to improve the identification of these containment

After a hot fire

lines by using the natural boundaries on Mardie Station, such as high, rocky country away from the creek lines, which impedes mesquite growth and spread. By using geographic information systems (GIS), the development of a 'habitat template' will help predict the spread of mesquite in the Pilbara by identifying the preferred habitats. These techniques will also be useful for designing containment zones elsewhere in Australia.

To prevent mesquite from crossing containment lines, staff at Mardie Station quarantine stock in a holding paddock that is free of mesquite for around one week until any mesquite seed in the gut has passed through.

All heavy machinery that enters the property is thoroughly washed before leaving the station. The cleaning is so thorough that a mesquite seed was once found in the duct of the air conditioning of a D6 dozer. Staff at

Results of leaf defoliation after biological control using *Evippe* spp.

the station also work with groups such as Conservation Volunteers Australia (CVA) to strategically spray mesquite that threatens to break beyond containment lines along the boundary of the station.

The formation of the PMMC has provided a basis for the integration of resources and knowledge, from those involved with mesquite management on a daily basis, to the innovative scientific research that has made possible the attempts to stop the spread of mesquite throughout the Pilbara and northern Australia.