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QUEENSLAND
DEPARTMENT OF
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BURNING

MULGA COUNTRY TO CONTROL WOODY WEEDS IN SOUTH-WEST QUEENSLAND

BURNING Mulga Country to control woody weeds in south-west Queensland

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SUMMARY

A burning management system for shrub control in the mulga country of south-west Queensland is beneficial for production and conservation by maintaining good land condition. The benefits include decreased shrub densities and increased pasture production; improved ground cover; reduced runoff; reduced wind and water erosion; reduced impact of drought and reduced income fluctuations. Benefits will be more evident on pushed or pulled mulga, or medium density mulga.

If the factors affecting the results are used to advantage, the benefits will be maximised. The type of shrubs, whether they are seedlings or resprouting, determines the season of burn. Climatic factors and the season of burn are also important for fire effectiveness and pasture regeneration.

Concerns over burning mulga country include 'scalding' the soil; pasture damage; sacrificing grass; a lack of short term returns and an influx of kangaroos. These are valid but manageable concerns. When viewing the 'big picture', burning is beneficial. To achieve the benefits graziers must be able to maintain a stocking strategy that will allow a burning management system to be implemented.

INTRODUCTION

Fire is the most practical means of controlling the woody weeds that have become a problem in the mulga lands. Woody weeds invade when pastures are heavily utilised and not burnt. They were not a problem before European settlement as wildfires and burning by Aborigines kept them in check. Moreover, grazing pressures were much lighter so that the shrubs did not gain a competitive advantage and there was enough fuel to support regular fires.

Conventional mechanical and chemical controls are too costly to use in south-west Queensland. However, research and on property experiences have shown that burning is a practical method of controlling woody weeds and of preventing their further spread.

PLATE 2. *The end result of frequently burnt mulga country*

THE BENEFITS OF BURNING

A long term burning management plan for shrub control will ensure maintenance of good land condition such that production and conservation are sustained. Pasture growth is encouraged where tree and shrub levels are kept low (See Figure 1).

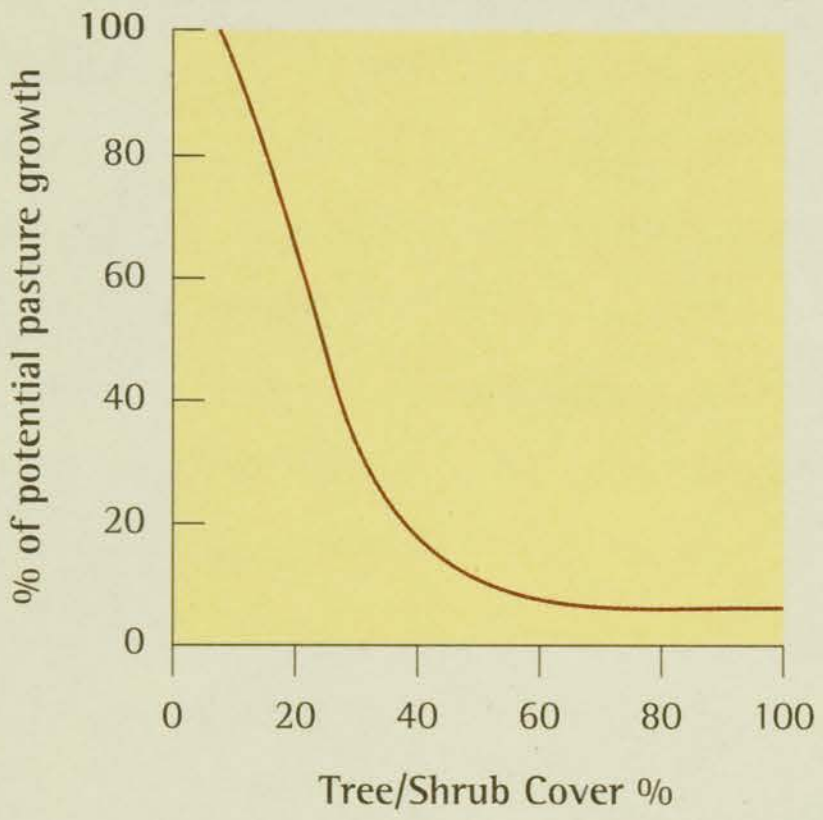

FIGURE 1. *Trees or shrubs reduce pasture growth (Reproduced with permission of I.F. Beale QDPI)*

The obvious benefits of a grassy woodland compared to a shrubby woodland with little grass include:

- improved ground cover,
- reduced runoff,
- reduced wind and water erosion,
- reduced impact of drought, and
- reduced income fluctuations.

A grassy woodland will soon become a shrubby woodland if shrubs are not controlled by burning. The shrubby woodland is a sign of degradation and encourages further degradation.

WHAT FACTORS AFFECT THE RESULT OF A BURN

Shrubs killed by fire

Shrubs that are killed by fire such as green turkey bush *(Eremophila gilesii)*, narrowleaf hopbush *(Dodonaea attenuata)* and fernleaf hopbush *(Dodonaea tenuifolia)* have their populations reduced by fire for about 3 years before they come back from seed (See Figure 2). Their prefire size will not be achieved for 5 years.

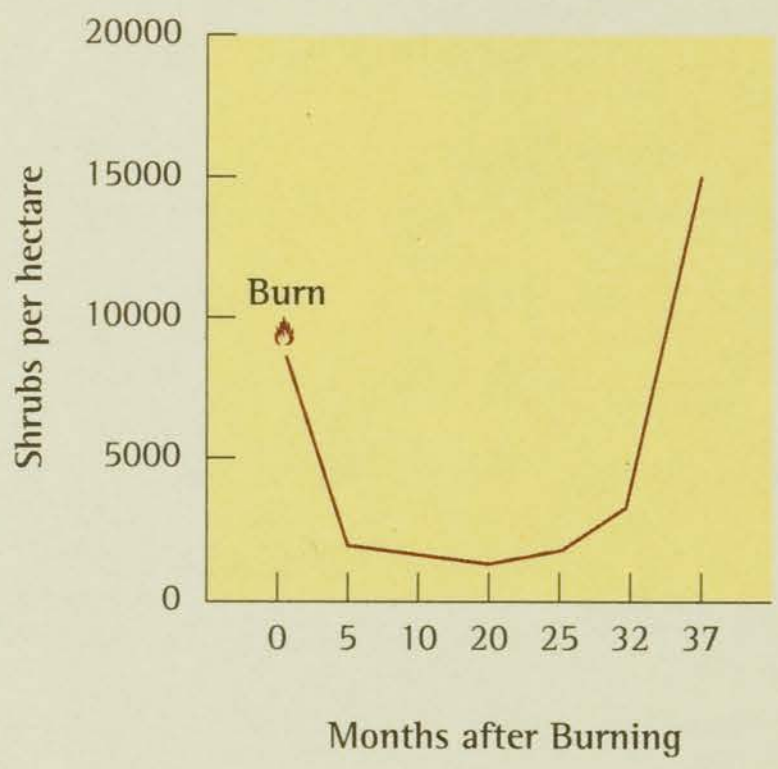

FIGURE 2. *Fire susceptible shrubs return from seed after 3 years (Reproduced with permission of A.J. Pressland QDPI)*

Young mulga *(Acacia aneura)* will also be killed by fire. Mulga will return from seed quicker than other shrubs. A rule of thumb regarding successful kills with these shrubs is that a flame height one half the size of the shrub is required to obtain a kill. Kills of 90% can be expected when these conditions are met. Mulga can germinate at any time of the year, however, it can be controlled by sheep grazing. Other woody weeds can also germinate at any time of the year, but are favoured by winter rainfall.

Resprouting shrubs

Shrubs such as sandalwood *(E. mitchellii)*, turpentine *(E. sturtii)* and grey turkey bush *(E. bowmanii)* have their size reduced by burning for about 5 years. While their resprouting ability means that usually only 10 % are killed, the surviving shrubs have a reduced ability to produce seed for about five years. Higher kill rates (85%) are achieved when shrubs are less than 15 cm tall. Seedlings of any type of shrub will be killed by fire (See Figure 3). Higher intensity fires will not increase the kill rate for established shrubs, however the extent of leaf scorch and size reduction will be increased.

Most mulga country has not burnt for between 20 to 40 years. Fires are hard to achieve, however, follow-up burns are less difficult. The follow-up burns can increase the mortality of the resprouting shrubs, particularly if in autumn.

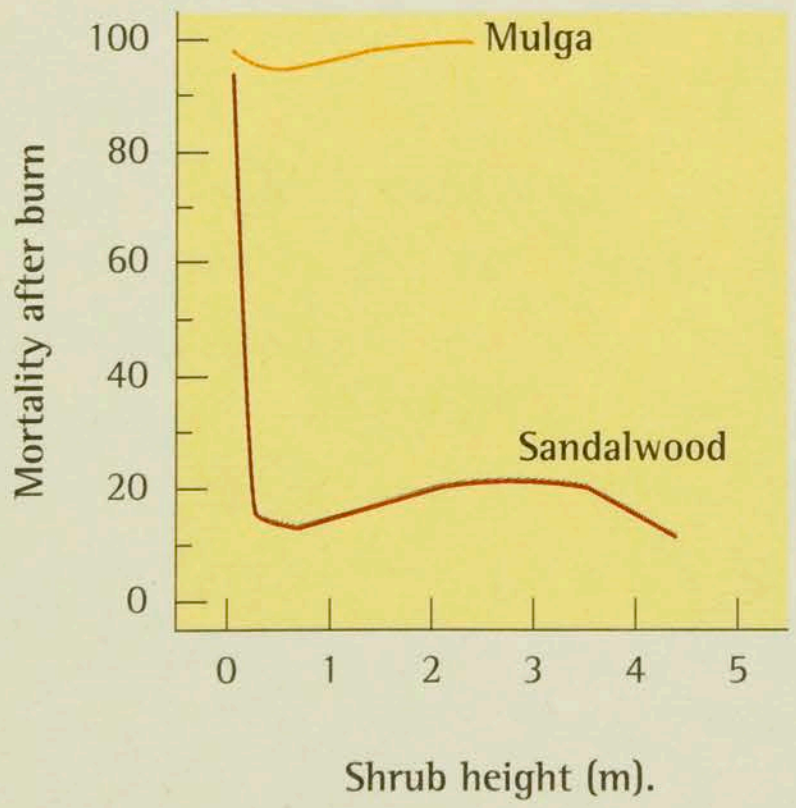

FIGURE 3. *Taller shrubs survive burning better than short ones (Reproduced with permission of K. Hodgkinson CSIRO)*

Burning different mulga land types

The benefits of burning have been demonstrated on hard mulga, soft mulga and mulga sandplains through trials and grazier experiences. The trials described in pages 7 to 9 were on hard mulga and Plate 2 was taken on a mulga sandplain. Hard mulga soils are more prone to runoff especially when the soil has reduced cover after a burn. Greater care is required when burning hard mulga particularly on slopes or hills. Cooler burns that retain logs on the ground are beneficial. These areas should be given every chance to regenerate to at least 600 kg/ha (See Plate 4), or with seed set on the pasture, before returning to grazing.

The season to burn

Burning in late winter to early spring is the best time to kill both seedlings and mature shrubs without unduly impairing establishment of grass and herbage species. Shrubs can establish at any time of the year however turkey bush, cassias and hopbushes are favoured by winter rain. Burning late winter to early spring gives the best chance of killing woody seedlings established in that year. Additionally it allows grasses the longest growing period. Summer burns are still better than none at all where there is a shrub problem. Often hot, dry conditions are necessary under limiting fuel conditions to assist a fire to carry. Ideal conditions are when there is some soil moisture to reshoot grasses immediately after the fire, however, these conditions are seldom obtained.

Research on burning resprouting shrubs with different frequencies and seasons has shown that 85% mortalities can be achieved when shrubs were completely defoliated by two successive autumn burns. Similar results can be achieved when the first burn is replaced by pulling or the second burn is replaced by a low rate herbicide application. Early results of this research are promising and if successful an integrated approach such as this could well double or triple the treatment life of a burn.

The types of shrubs therefore determine the season of follow-up burns. A pasture predominated by fire susceptible shrubs that has been burnt and has shrubs returning from seed is best burnt in late winter to early spring. A pasture with mainly resprouting shrubs that has been pushed or pulled for less than 12 months is best burnt in autumn. This should give a high mortality of the resprouting shrubs.

Climatic factors are important

Biologically the best time to burn is coming out of a cool season, when there is plenty of dry fuel, wet soil, and before much new grass growth has started. Burning pushed or pulled areas under these conditions will reduce the amount of burnt timber and therefore reduce the 'scalded' areas.

If it is safe, burning under hot dry conditions is acceptable and will not damage the pasture even when followed by drought. This is provided the grazing pressure allows the pasture to regenerate.

The hotter the fire, the better the kill. This creates a conflict between managing the fire and killing the shrubs. Accordingly it is essential that the integrity of firebreaks is guaranteed.

The most effective fire is one in the middle of a hot day (33°C or higher at midday), with a light, steady breeze (a fire that advances slowly kills better than one that races across a paddock, all other things being equal), burning up a slope or on flat land, and with a high fuel load (at least 1000 kg/ha). These conditions also apply to patchy burns by assisting the heat to affect shrubs outside the burnt area.

Generally the opportunities to burn are rare and should be taken advantage of. Too often burning is deferred, fuel loads deplete, shrubs keep growing and the potential for future burns is reduced.

PLATE 4. *600 kg/ha, or when the pasture has set seed, is when it is ready for a return to grazing*

How much fuel do you need?

The greater the fuel load the greater the shrub kill or degree of defoliation for resprouting shrubs. The taller the shrub the greater the fuel required for leaf scorch. Most mulga paddocks are limiting in fuel. A minimum of 1000 kg/ha (See Plate 3) is required for a fire to carry. A buildup of litter on the ground is helpful for the fire to carry across bare areas.

PLATE 3.
1000 kg/ha is necessary to carry a fire

Post-burn management is essential

Where a whole paddock has burnt, grazing straight after burning is one good way to ensure that the woody weeds return in greater numbers than before. Not only is there little competition from other species to impede the re-establishment of woody weeds, but grazing ensures that there will be insufficient fuel to support the follow-up fires that will certainly be needed.

Paddocks completely burnt need to be destocked to allow grasses to regenerate (regeneration means reaching a grass yield of 600 kg/ha or setting seed – See Plate 4).

The minimum time is one entire summer, assuming that a reasonable amount of rain falls (dry summers do not count). Implementing kangaroo control measures should be considered. Mulga regeneration can occur earlier than other shrubs. This can be controlled with sheep grazing. However, it can be difficult to achieve because the mulga can establish before the grasses have set seed and they may not be ready for a return to grazing.

After the first burn, a second burn is usually easier to achieve because of the reduced competition from shrubs. This is also true with patchy burns where the area burnt increases with the second burn. The second burn should be high on the priority list. Some shrubs will be returning from seed after the first burn. As seedlings they will all be killed by the second burn. The shrub soil seed bank will also be drastically reduced by the second burn.

An area near Adavale was burnt by wild fires 4 times in 30 years following above average rainfalls. The mulga was also pushed out during the middle of this period. The area is now a well grassed open woodland just as the early explorers have described (See Plate 2).

Benefits of follow-up burns

If a second burn can be implemented within 4 years, then a significant impact on shrubs can be obtained. Shrub seedlings have usually had a chance to germinate. These seedlings are fire susceptible regardless of species and their death contributes to a large reduction in the soil seed bank. Fire may promote the germination of acacias, cassias and hopbushes. This usually only occurs where seed has collected under logs and the fire has been more intense. Additionally the reproductive capacity of resprouting shrubs is reduced for 5-10 years thereby restricting the amount of seed added to the soil seed bank.

COMMON CONCERNS ON BURNING

Burning pushed or pulled mulga will 'scald' small patches

Where pulled timber is burnt the grasses underneath often die due to the intense prolonged heat. These areas become bare and are often referred to as 'scalded' areas. Trials have shown that these 'scalded' areas comprise only 5 to 10% of an area and do not decrease the overall pasture yield (See Figure 4). The 'scalded' area can be reduced by burning after rain with some soil moisture. These conditions are not always possible.

The 'scalding' involves nutrient removal and relocation. The processes involved are that the 'scalded' areas produce runoff for adjoining areas where soil particles, litter and seed collect. These runon areas then become more productive.

Pulling or pushing mulga often increases pasture yield and burning will maintain it. A common situation is mulga regeneration following pushing or pulling. There are two possible scenarios in the long term following this event.

1. If the area is not burnt the mulga will continue to grow until it is only suitable as a drought fodder 10 or 15 years later. Pushing or pulling again will then result in double the amount of timber on the ground. Due to the slow breakdown rates of mulga if this kind of management continues there could be a large amount of timber on the ground after, say 50 years. The timber on the ground will continue to increase. If a burn occurs, then the 'scalded' areas will increase proportionately with the amount of timber on the ground.

2. Conversely, if the area is burnt following the first pushing or pulling the young mulga will be controlled and the amount of 'scalding' will be minimised. The amount of timber on the ground will be reduced. This management encourages the area to become a grassland. Each subsequent burn further reduces the timber on the ground therefore further reducing the 'scalding'. After, say 50 years and three burns the area could be an open grassland with virtually no timber on the ground.

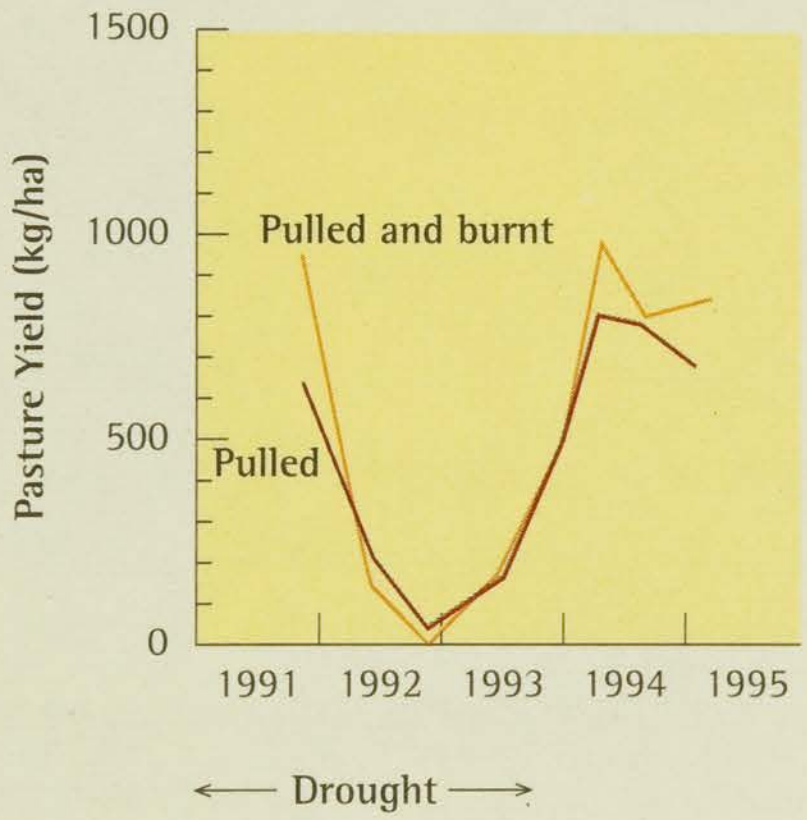

FIGURE 4. *Burning pulled mulga country does not decrease the overall pasture yield even during severe drought*

In very degraded areas pushed or pulled mulga trees may be the only place where grasses can establish. These 'mulga mounds' then have an important role as a source of grass seed for the rest of the area. On the other hand where there is sufficient grass between the mounds to carry a fire across the whole area, the mulga mounds are no longer required and their contribution to the overall pasture yield is insignificant.

Pushed or pulled mulga trees can assist a fire to carry where the grass fuel load is limiting. If stock are not consuming the mulga leaf, it creates a volatile fuel when dry on the pushed or pulled tree. Dry leaf enables burns to be achieved three months after pulling. This was successfully achieved at Charleville where burning was implemented in December 1991 following pulling three months earlier. The mulga was in a medium density stand and following pulling the dry leaf still on the branches considerably helped the burn to carry compared to burns in standing timber.

Burning during and when followed by drought will not harm the pasture

Concerns over sacrificing grass are increased when drought follows burning. However, during extended dry conditions if pasture is not utilised as feed or as fuel for a burn, it can be lost within 6 months. Detachment, harvesting by insects and kangaroos can account for the removal of all the standing feed over this period. Additionally, during a severe drought, when pasture is starting to detach, it loses most of its nutritional value and may be utilised as a burn for shrub control. Trials have shown that mild fires (1000 kg/ha) even in the hottest part of summer, during and followed by drought, will not affect the pasture response to subsequent grass growing rain (See Figure 4).

Burns were conducted at Charleville in a destocked paddock during one of the worst droughts on record and pastures did not receive grass growing rain until 19 months after the burn. The pasture growth then showed that there were no detrimental effects in terms of pasture yield, types or density. The paddock was destocked during pasture regeneration. Grasses are usually not killed by grass fires because the growing points are protected from the heat by soil and leaf sheaths. Woollybutt is the exception and can be killed by fire, especially during drought.

Sacrificing all that grass is necessary

Another concern with burning is that the grass is sacrificed. The amount of grass required for a burn (1000 kg/ha) would have also fed one dry sheep equivalent (DSE) per two hectares for the next 12 months if 20% of the feed is to be utilised. For a burning management system to be successful these losses must be absorbed within the property management system. If it can be achieved this management will prevent the long term degradation and productive decline associated with high utilisation levels and failure to burn.

Kangaroos will not prevent burns

Kangaroos do impact on pasture growth although this has not yet been quantified. Their impact is not large enough to prevent burning occurring altogether. A destocked pulled area near Charleville was burnt in 1991 and 1994 without any kangaroo control. The summer rains producing the 1994 burn were equal to the summer average indicating that rainfall well above average is not required. Much of the south west burnt in the 1950s and 1970s. Areas near Adavale burnt four times over a 30 year period. Several properties in the south west have destocked paddocks and burnt for woody weed control. These examples demonstrate the frequency with which burns can occur despite kangaroos. However reducing the impact of kangaroos by implementing control measures especially during the post burn pasture regrowth period should be considered.

Crown fires should be avoided

There is little information on crown fires apart from the observations by graziers that they can be damaging to pastures. They should be avoided at all costs because of the obvious risks to people, infrastructure, wildlife and livestock. Crown fires occur when there are several above average seasons generating a large body of feed followed by a dry spell. Every effort should be made to implement hazard reduction burning prior to these dangerous conditions developing.

Economic benefits are not present in the short term

Shrub control by burning is a maintenance operation. It does not lead to short term production improvements and therefore short term economic benefits are not present. However in the long term the benefits of a grassy woodland compared to a closed shrubland include reduced runoff, less reliance on mulga as a drought ration, reduced incidence of drought and improved livestock management. Therefore the benefits of a burning management system include the maintenance of pasture production and carrying capacity. It is expected that economic benefits will accrue over the long term (20 years).

How much to burn?

Burning needs to be part of the overall management plan for a property and cannot be done in isolation from the rest of the management strategy.

On the one hand, a large enough area needs to be burnt to make significant inroads in the total shrub population. On the other hand, the burnt area needs to be destocked after burning to allow the pasture to recover and to build up fuel for the follow up fires that will be needed; this effectively shrinks the property's useable country.

Thus stocking policy needs to be carefully integrated with the burning policy and a safety margin needs to be added to cover the possibility of a dry season following the fire. If the rest of a property is overstocked as a result of destocking a burnt area, the net effects will be negative.

Often a paddock is too big to take out of production completely and only 1/4 to 1/3 will burn. In this case destocking is not possible however grazing pressure should be reduced to allow the burnt areas to regenerate. In this situation patch burning can be implemented. Rather than lighting on a front, areas are lit where the fuel load is available and the fire carries itself through these areas. This sort of burning in cool conditions is very safe for operators and wildlife has more chance of surviving the burn.

FIRE CONTROL

Burning firebreaks

Firebreaks are absolutely essential and need to be wide as fires have been known to jump more than a hundred metres.

In cooler months, a firebreak 5 metres wide may be sufficient, but, in hotter months, firebreaks of at least 50 metres will be necessary.

The best conditions for burning firebreaks are the reverse of those for shrub control. Fires lit in the late afternoon, or which burn into the night, are generally easier to control, as are fires burning downhill or burning into the breeze.

Water is the key to control. As a rule of thumb, one fire unit (two people with a four-wheel drive vehicle with a 400 litre tank, a pump with two hoses, and a two-way radio) will be needed for every 400 hectares to be burnt. A grader or dozer may also be needed.

Early winter is the preferred time to burn breaks along roads and around buildings and yards.

Burn breaks within paddocks after rain. Use great care and have adequate equipment on hand.

After the fire, it is essential that all flaming or smouldering patches on the perimeter are totally extinguished to eliminate any chance of the fire reviving and jumping the firebreak.

Permits to burn

The Rural Fire Division, Queensland Fire Service is the state government organisation empowered to control burning by the 'Permit to Burn' system. A landowner wanting to burn must ask his neighbours' permission before applying to the local fire warden for a permit to burn. Burning without a permit is a breach of the Rural Fires Act and can incur penalties of fines or imprisonment or both.

Details of local wardens are available from the Rural Fire Division or the Local Chief Fire Warden (Clerk of the Court or Police).

CONCLUSION

The most interesting aspects of this summary are the benefits of burning, despite the common concerns. The benefits of a long term burning management plan for shrub control in the mulga country of south-west Queensland include decreased shrub levels and increased pasture levels; improved ground cover; reduced runoff; reduced wind and water erosion; reduced impact of drought and reduced income fluctuations. Production and conservation will benefit from maintaining good land condition.

Benefits will be maximised if the factors affecting the results are used to advantage. The type of shrubs, whether they are seedlings or resprouting determines the season of burn. Climatic factors and the season of burn are also important for fire effectiveness and pasture regeneration.

There are valid concerns on burning including 'scalding' the soil; pasture damage; sacrificing grass; a lack of short term returns and the influx of kangaroos. These concerns are manageable.

Implementation will occur most readily on areas of low tree density such as pushed or pulled mulga, or medium density mulga. To achieve the benefits graziers must be able to maintain a stocking strategy that will allow a burning management system to be implemented.

FURTHER READING

An introduction to south-west Queensland. (1995). DPI Charleville Pastoral Laboratory.

Property development and green timber treatment guidelines for south-west Queensland. (1990) Warrego Landcare Group.

Woody weed management strategy. Proceedings of National Workshop. (1992) Woody Weed Task Force. Cobar NSW.

Rear cover: Frequently burnt mulga country

Front cover: Burning mulga country