LAND MANAGEMENT MANUAL WAGGAMBA SHIRE

PART C

LOCAL PERSPECTIVES

QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

WAGGAMBA Conservation Committee

Keeping our land productive

Queensland Government Technical Report

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LAND MANAGEMENT MANUAL

WAGGAMBA SHIRE

PART C

LAND MANAGEMENT IN WAGGAMBA SHIRE

LOCAL PERSPECTIVES

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This we know: The earth does not belong to man, man belongs to the earth. This we know. All things are connected like the blood that unites a family. All things are connected.

Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life he is merely a strand in it. Whatever he does to the web he does to himself.

Chief Seattle, in reply to the 'Great White Chief' in Washington about an offer for the Indian land. 1854.

FOREWORD

WHY LAND CARE?

In the business world, no one blinks an eyelid at the suggestion of using management tools to improve efficiency. To me, land care should be regarded by the rural sector as a management tool. I see the Land Care Committee's function as being a mechanism whereby we can package the message of improved land management to the user, the farmer and grazier. Land management practices may be farm planning, soil conservation, conservation tillage, shadeline management, balanced land clearing policies or correct herbicide application techniques - different areas will interest different landowners at different times.

This part of the manual provides a number of articles dealing with management situations occurring within Waggamba Shire. Members of the Waggamba Conservation Committee and other contributors have written about their personal experiences of these situations. They tell how they recognised the problems, and the solutions, if any, they were able to implement.

The Waggamba Conservation Committee is not intended as an environmental watchdog, but as a provider of information to the land holder. Therefore, it is hoped that by sharing these experiences similar problem situations can be avoided, or overcome more easily, with land holders being in control of maintaining long term productivity of the land.

Katrina Cameron

THE HISTORY OF AGRICULTURE IN WAGGAMBA SHIRE

Kim Felton-Taylor

Establishment of permanent European settlement of the area now known as Waggamba Shire occurred during the 1840s. Squatters were in the area before this time for short periods but most left because of resistance by aborigines to white settlement.

The Queensland Land Act of 1860 provided for the lease of unoccupied Crown Land from 25 to 100 square miles per selection. There was no limit on the number of selections one person could lease.

Resumptions of land from large holdings followed the Dutton Land Act of 1884. Land ballots were held for taking up Closer Settlement Leases, the last being held in 1966. Government of the day dictated the size of area to be selected. Generally speaking, Labor Governments made selections much smaller as they considered that a selection should give a family an income equal to what was then the basic wage.

Conditions of the lease required the clearing of country and maintaining it free of regrowth. The Act also enabled lessees to claim compensation for ringbarking on their selections.

The following comments were compiled from diaries of people who drew blocks in the ballots :

1920. *Mr T. Wilson drew 3700 acres north of Bungunya. He came there with 32 head of cattle, 15 horses, 3 dogs, 20 sheets of iron, a shovel, an axe, a pick and a pioneer's heart. He started to level a site for a dwelling the very first night.* (The property is still held by the family.)

1934. *Mr Bob Benson, age 22. Drew 20 000 acres part of Retreat Station. All thick scrub. 80 % brigalow-belah, the balance box and sandalwood with iron bark on ridges.*

'I was told by local agent to take my coat off when I went onto the block so I could walk between the trees.' No fences at all. No water and no buildings. Prickly pear had gone but the residue and grubs were still on the ground. This had to be raked away before camp could be made. Because of no water sheep could not be run in summer. Sold in early summer in good condition, having lived on salt vine and spade grass.

Depression was in full swing. Condition of the lease mainly to fence and ringbark. Lands Dept. supplied netting for dingo control and loaned money to fence, water and ringbark selection.

Government paid for unemployed men to ringbark selection. 'I would sign certificate of work and the men would be paid in Goondiwindi on sight of the certificate. Things were tough. I did not have spare money to buy a camera to take photos of the land of my first camp.' (Still in family hands.)

1956. *C.R. Baker. Drew 3300 acres. Age 18. Part of Wyaga Station. One of five selections taken from Wyaga Station. Thick brigalow-belah scrub with small area of sandridge and white rock ridge. All heavy timber, no water or internal fencing. 'I arrived with all my possessions on the back of a truck, promptly got bogged and decided this was as good a place as anywhere for my home.'* (Home still there and still lives on selection.)

From early writings of settlers it appears that much of the present box-coolibah country was open savannah and quite suitable for grazing. Brigalow-belah country was referred to as scrub. It seems that much of the country referred to as thick brigalow-belah scrub since the early 1920s was originally timbered with scattered clumps of belah and brigalow. Fire is the most probable cause of this change in tree density.

In 1904 a huge fire started at Nindigully and raged unchecked to Dalby. A grazier of the time stated 'That was the beginning of the scrub. Before the fire the country was fairly open.' Similar remarks were made about the thickly timbered area between Goondiwindi and Yelarbon. It is recorded that this was open country prior to the turn of the century.

Cattle and sheep grazing was carried out from earliest settlement. However, sheep faced considerable risk from dingoes which were numerous in the area. The more remote and heavily timbered areas were used mainly for cattle. Wyaga Station was running 22 000 sheep on open box flats in the 1860s. No ringbarking seems to have been carried out before this decade.

Fire, drought and floods did not make conditions easy for early settlers.

Drought of 1901-03
(Extracts from diary of Mr A.F. Evans of Oonavale)

September 1901. *Cutting wheat for hay for sheep*

December 1901. *114 °F. ...cutting prickly pear for sheep*

February 1902. *Fearful drought still rages. Country looking very low. No feed and water failing fast.*

September 1902. *Stock about on their last legs and without immediate relief in the way of a good fall of rain great losses must occur.*

October 1902. *Great heat still continues. No sign of rain. All hope of saving any sheep gone, 13 out of 90 rams still alive.*

November 1902. *I am sorry to report a big loss in the sheep on this property. After the storms on the 28th October, which made a little water in the clay pans about the paddocks the sheep split up into twos and threes everywhere and the great heat that followed seemed to kill them wholesale for they could not get together and would not come to the wells for water.*

January 1903. *Temp 122 °F. Broke the record. Hell could not be worse.*

February 1903. *Collecting dead wool and baling as had been all of 1902. Cut prickly pear for sheep all 1902.*

August 1903. *25ft flood reported coming. Drought over!*

1927. *The Callandoon bookkeeper had telephone switchboard with access to eight phones of properties down river. Flood time, police in Texas would send riders down river to let people know when the river was going to flood. Practice of 1920 - wool would be washed after shearing.*

1950, Major flood. *Callandoon had 1000 acres of country out of 30,000 that was not flooded. Fodder was dropped for 6 weeks. The only transport was flat-bottomed boat.*

Clearing

Considerable areas of land were rung for grazing after the Dutton Land Act of 1884 was proclaimed.

Box country was easier to clear and more productive for sheep than brigalow-belah country. Contract gangs of eight to fifty men systematically rung areas leaving generous shadelines and timber on creek frontages. All areas contracted out were measured with prismatic compasses which proved to be very accurate when later checked by surveyors. Country was rung and then burnt several years later. Sucker regrowth was a problem if the country was burnt too soon after ringbarking.

Wyaga Station pulled an area of brigalow-belah scrub on Caratel in 1949-50 with two D6 dozers with a wire cable. This was subsequently burnt and stick-picked by hand. From the late 1950s to the 1980s the advent and availability of larger crawler tractors with pulling chains meant larger areas of scrub could be pulled and raked in much shorter time than could be envisaged prior to World War II. From the late 1950s large areas of the shire have been cleared in this way.

Chemical control of brigalow suckers was trialed experimentally on Kilbronae in 1952. This was applied by ground spraying 2-4-5-T and oil mixture on brigalow suckers. This type of control has not proved to be very successful. Lately, aerial application has also been used.

New chemicals control suckers and regrowth successfully. These have a place in controlling outcrops of suckers in grazing country where mechanical control is not required.

The advent of large blade ploughs and offset ploughs has made the control of large areas of suckers much easier. It has also enabled country to be brought into cropping and pasture production more quickly.

Prickly pear

Prickly pear was introduced to Billa Billa in 1860 by the then owner, Mr. Easton. It was initially planted as a hedge round the front of the garden. Some was sent to Mr. Easton's brother at Tarewinnebar and other leaves sent to the sheep hands to plant round the sheep folds. As is well known, this spread over the whole shire and was the cause of serious decline in production and hardship for the lessees.

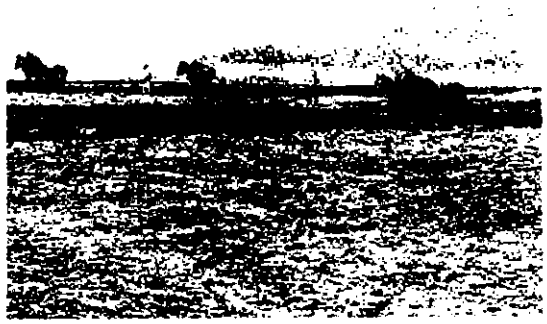
Chinese gangs were employed to rid the pear. This was done by collecting the pear into large heaps and burning, a very slow and costly job. The Queensland Prickly Pear Commission developed various poisons to try to control the pear but with limited success. Many lessees walked off land because of the cost of clearing pear and loss of production.

In 1924 the owner of Tarewinnebar (87 square miles) was given an estimate of £350 000 ($700 000) to clear pear from the holding. The owner surrendered the lease. Not until the late 1920s with the introduction of *Cactoblastis* did lessees get on top of the pear problem. Most of the pear was gone by the late 1930s with dead pear still on the ground in 1945.

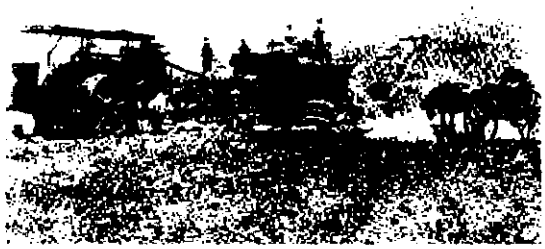
Cropping

Cropping was started east of Goondiwindi in 1909. In 1910, 94 acres (38 ha) of wheat yielded 710 bags. With the railway line from Yelarbon to Goondiwindi being completed in 1908, land was resumed for closer settlement. Areas of 320 to 1200 acres (130 to 490 ha) were devoted to dairying and cropping. This was cleared by hand. One hundred and fifty farmers supplied cream to the Goondiwindi Butter Factory which produced ninety tons of butter a year.

Wheat for feed for working bullocks and stock horses was grown in the Bungunya district. It was usual to have the country stick-picked and burned, then ploughed by bullock teams. The crop was allowed to grow to a height of six inches (15 cm) then rolled down with a log to promote tillering. When at full height, the crop was harvested by a reaper and binder. This was then stacked in sheds for later use in the season as needed. This system was used by Mr. Rogers of Redfield and Mr. T. Wilson of Tori from the late 1920s to the early 1930s.



Cropping for grain started in the area around Wyaga and north of Yelarbon in the late 1930s. Wheat was grown on cleared scrub country north of Yelarbon in 1938. An area of scrub on Wyaga was cleared with bullocks and farmed for oat production at the same time.



The lease conditions of clearing of country and maintaining it free of regrowth aided the rapid expansion of agriculture. Figures for the number of hectares of crops in the shire from 1958-9 to 1987-8 follow and give evidence of this explosion:

Year	Area of crop (ha)
1958-59	9 040
1962-63	22 456
1966-67	57 334
1970-71	124 47
1974-75	120 000
1978-79	162 703
1983-84	219 141
1987-88	252 000

Source: Australian Bureau of Statistics

Dryland cotton was grown east of Goondiwindi in the early 1930s. The cotton crop was planted and picked by hand. The crop was not economically viable and cotton was abandoned. Not until 1981 when Macintyre Downs first grew irrigated cotton in the district did it expand once again.

Mike Gibb's cotton was the first to be ginned at the new Goondiwindi Gin in 1984. Figures from 1988 show that 2200 ha of irrigated cotton was grown. There are also significant areas of dryland cotton being grown in the shire. Areas of irrigated cotton for the shire are:

Year	Area of irrigated cotton (ha)	
1985	1 485	
1990	4 442	
1993	7 000	(projected)

Major expansion of cotton planting is expected in the future.

Wheat and cattle currently have the highest gross income in the shire. Although Waggamba Shire has the seventh highest number of sheep among Queensland shires, numbers continue to decline in favour of cattle due to economic conditions.

EROSION AND ITS CONTROL

Hugh Gloster, Geoff Woods and Ron Ladner

Prior to development, soils in Waggamba Shire were reasonably stable. The clearing of scrub, ploughing and the introduction of domestic stock have dramatically increased the rate of soil loss in the shire.

Time taken for erosion to become apparent after the development of land varies considerably with the land in question, the seasons which follow development, and the management of the land. Most soils show some form of accelerated loss almost immediately after clearing. As a rule of thumb, if erosion can be noticed without objective measurements, then it is too much.

Overstocking on grazing land has caused the invasion of woody weeds and galvanised burr and has increased erosion. Erosion in this shire has also been caused by clearing of fence lines and seismic operations. Construction of diversion drains and planting of grasses have reduced erosion in these situations.

Ground cover, particularly in summer months, has been shown to be very important in controlling soil loss. Ground cover can be provided by most crops, pasture and some crop residues. Cereals such as wheat and barley provide good ground cover and good summer residues if properly managed. Crops such as grazed oats, sorghum, sunflower and chickpeas will leave the summer fallow more exposed to the elements.

Since winter cereals are the most widely grown crops in Waggamba Shire, we have found that stubble management is of the utmost importance in reducing soil erosion. Good stubble management requires that the maximum amount of straw is retained on the fallow surface from harvest until well past planting. This can be achieved by zero or reduced tillage methods. A number of farmers in the district have successfully used sheep during the summer fallow, particularly with zero till, to assist in controlling scattered weeds and summer grasses.

We have found that earthworks are also required if the farming process is to be sustainable. The necessity for earthworks is not confined to ploughed land but also to some grazing lands with pronounced slopes and inconsistent ground cover.

The following two experiences indicate some of the difficulties resulting from erosion, and the means by which they were overcome.

Coorangy

The first experience on Coorangy demonstrates some of the problems that occur with natural waterways.

On Coorangy, the problem of erosion did not become apparent immediately after farming the country, but later, several uncharacteristically heavy rainfalls started a process which rapidly worsened.

At first I believed the natural drainage lines would handle the runoff but these began to fill with silt which caught in the grass. This silting forced the water outside the drainage lines and eroded the edges of the cultivation. This in turn led to these eroded areas being excluded from cultivation. These eroded areas then became grassed and the process continued, leading to a further widening of the original drainage lines.

At first we tried forcing the water back into the original drainage lines by constructing *herring bone* banks, but the continual siltation process forced the water either around or over these banks. The solution to this problem required that the siltation be reduced before drainage lines could be properly managed.

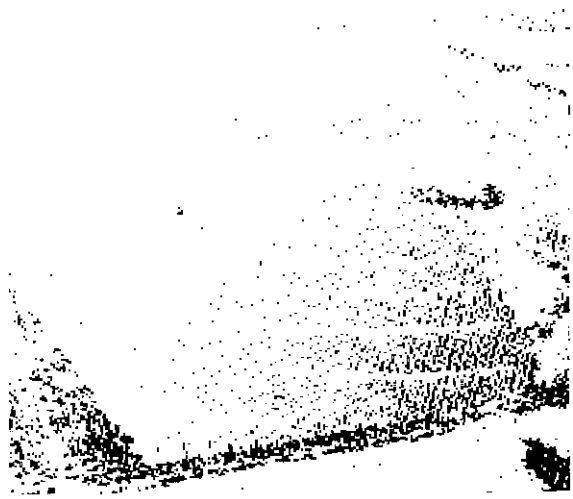
In 1976, I switched from burning stubble after harvest to retaining the crop residue by using chisel ploughs. I also started farming the steeper country along the contour lines. Whilst this reduced the soil erosion in drier years, the problem was still worsening.

The wet years in 1983 and 1984 led to a decision to construct waterways and contours designed by the local Soil Conservation Officer. The waterways and contour banks have proved very effective in reducing the erosion and the siltation. This could probably be further improved by changing from stubble retained farming to zero till. I believe that the earthworks are necessary and that zero till alone would not reduce the erosion sufficiently.

I also believe that the earthworks are necessary as the land can become very bare and exposed when it is

being long-fallowed from wheat to sorghum and vice versa. The soil can also be exposed to erosion after a poor crop caused by a bad season.

The waterways and contour banks require good management practices. I find it necessary to prevent the waterways from being denuded of grass in the dry times. If the waterway is overgrazed it may begin to erode, particularly where the contour banks enter. The waterway and contour banks are worn down by cattle and require maintenance.



Gooralie

The second case highlights the need for having waterways, particularly where sloping country meets melonhole country in cultivation areas.

On Gooralie, approximately seven years ago (1983), on country ranging from sloping ridges to melonhole country, we began to have erosion problems. This country had only been cleared of brigalow in the previous seven to eight years.

We noticed that the water ran off the ridges and filled the melonholes. Over a period of a few years the water found its lowest level and ran from melonhole to melonhole causing a gully to form, winding its way across the paddock and eventually running into a dam in another paddock.

This problem was compounded and hastened in 1983-4 by having 1675 mm of rain recorded in less than two years when the average annual rainfall is approximately 550 mm.

At the present time, this gully is approximately 3 to 5 metres wide and 1 to 1.5 m deep. It has branched into a Y at one particular area but has otherwise remained fairly static over the past three to four years.

We have now started building a waterway system to incorporate the length of this gully down to the dam previously mentioned.

I believe the reason the gully has remained fairly static in recent years is that the farming practices have changed from conventional to minimum and zero tillage. We have gone from initially one-way ploughing the stubble, then working the country a couple of times with a chisel plough, to using a spray and more sheep to control weeds on cultivation country. Leaving the stubble standing obviously lessens runoff and retains more water in the soil profile.

CROPPING SYSTEMS

Hugh Gloster

Introduction

Conservation of moisture and soil is necessary to farm successfully. Without stored moisture, reliance is on rain falling during the growing period for successful crop production. Since 1977, I have used cropping systems which take these measures into consideration. Initially, I used cultivation techniques to kill weeds and keep a surface cover of cultivated soil to prevent moisture escaping.

New techniques have shown there is no need to cultivate to store moisture. With the sensible use of chemicals, stubble can be retained on top of the ground and weeds can be killed quickly, thus preventing their using moisture. Standing stubble prevents raindrops from compacting and sealing the soil surface and slows runoff, thereby allowing the soil to soak up more moisture as well as reducing erosion.

Moisture preservation techniques

Stubble retention can be achieved by either zero or minimum till techniques, only cultivating at planting time or not cultivating at all by using special planting equipment. I have found that zero tillage can be done economically by using chemicals when weeds are small, in conjunction with sheep eating any remaining weeds and seed that are left on the ground. Sheep do not compact the soil as much as cattle. If numbers are reduced when the bulk of the weeds are under control and during wet weather, sheep will tend to keep to the tree lines when the soil is wet.

I have found several advantages of zero tillage on my property.

· When uncultivated, the ground tends to crack open as it dries out. When it rains, moisture penetrates through the soil profile instead of having the cultivated soil saturated and water running off while the subsoil is still dry.

· The weed seeds are shed on uncultivated soil thus leaving them open to the elements so that many rot, are burned, eaten or sprayed before they germinate. With cultivation, the weed seeds were, in effect, planted back into the soil.

· The natural expansion and contraction of the soil, caused by wetting and drying, keeps the topsoil soft and allows planting to be carried out without cultivating first. The use of press-wheels helps emergence. I have found the less expensive use of harrows achieves an acceptable germination rate on friable soils.

· Planting time can be more flexible as stubble and uncultivated ground keep the moisture in the planting zone longer.

· By using spray trucks instead of large tractors and cultivators to control weeds, the number of hectares that can be controlled in a day is increased. This reduces the time weeds use moisture from the subsoil.

· Spray trucks are lighter than large tractors so paddocks can be reached sooner after rain and they cause less compaction of the soil. Crops can thus be planted earlier and get their roots into the subsoil to make better use of subsoil moisture and nutrients.

Winter cropping

I have found winter cropping to be most successful in this area to date, because the weather is milder and a lot of moisture can be stored during the higher rainfall period of summer. This has led to mono-cropping of wheat with some barley, feed oats for grazing and lucerne. In the last few years chickpeas have been introduced as a grain legume to provide another alternative.

Chickpeas are just as profitable to grow as wheat and have lasting effects by leaving some nitrogen in the soil for future crops. Being a taprooted crop, they can also get through a compaction layer better than wheat and thus make better use of subsoil moisture and help aerate the soil. When growing chickpeas, in-crop weed control of broadleaf weeds with chemicals is difficult as few are available to date. *Phytophthora* root-rot can wipe out some or all of the crop, especially if it is grown in the same paddock for more than one year, is grown on flooded land or where water has a tendency to lie.

Summer cropping

I have not had success with sorghum to date due to the extremes of temperature and rainfall. In order to combat weeds in the winter, however, a summer rotation is needed. My experience has been that heat blasting of the early-planted sorghum crop at flowering and seed-set severely reduces yield, especially if there is also some moisture stress. Excessive heat on newly emerged late-planted crops has the same effect. Even though half the annual average rainfall usually occurs during the summer, it can all fall in a few days. This makes summer a period where cropping is a big gamble unless, in the case of sorghum, you have cattle to eat the crop if it does not yield grain.

Dryland cotton is now making its mark as an option for summer cropping. Being a desert-type plant with a taproot and having a longer growing and flowering period, it makes better use of subsoil moisture than sorghum and can take advantage of late rain to fill the bolls. I have found it essential to use an expert for advice on insect and weed control. Good management of this crop is essential.

Cotton has a high initial financial outlay, though I have had better success with cotton than sorghum.

Benefits of rotation

Winter cropping is the mainstay of my farming enterprise, though I have found the following advantages of rotation:

- It breaks disease cycles of both roots and leaves;
- It helps reduce weed problems;
- When a legume is used, the fertility of the soil is improved due to the nitrogen-fixing ability of the plant;
- Taprooted crops can be used to help break plough pans;
- Cropping throughout the year makes better use of machinery and labour; and
- Risk of crop failure is spread over a year rather than one season.

PASTURE MANAGEMENT

Norm Fox Sr.

Native pastures are an association of many species of grasses and herbs. Stock tend to select and preferentially graze the useful species and leave the unpalatable species (such as wiregrass, three-awned speargrass and white spear).

Management strategy

My objective in the management strategy for native pastures is to encourage the growth and the density of the useful species such as Queensland bluegrass and the medics. For example in 1987, Queensland bluegrass seeded in May and the medics started to produce flowers and set seed in June or July in spelled or lightly grazed pastures. I found this an ideal opportunity to get a seed bank of these useful species on the ground.

I organise stock movements so that heavily grazed paddocks can be spelled or very lightly grazed during the growing period to allow grasses to build up their root reserves and extend their crowns and for new plants to establish and so improve the ground cover when possible.

The better grassed paddocks on my property are usually the bull paddocks which are spelled between September and the end of January when bulls are with the breeders. Conversely, the continuously grazed horse paddocks are usually the worst.

One advantage of early weaning is that it reduces the grazing pressure in the breeder paddocks at a critical times: from April-May and into the spring. Similarly, weaners do better in a fresh paddock that has been spelled between December or January and April or May.

Monitoring

I have found it important not only to watch the condition of the stock, but also to watch the paddocks and estimate feed availability and adjust grazing pressure for the coming months. On an annual basis I consider whether or not particular paddocks are going back and plan to adjust stocking pressures accordingly. I use amount and condition of ground cover as an indicator of stocking pressure.

Sown pastures

Native pasture management becomes a little easier if there are paddocks of sown pasture or fodder crops that can be used to take the pressure off native pastures at critical times, but sown pastures are costly to establish, both in terms of seedbed preparation plus the costs of seed and sowing. On the better soils, sown pastures can remain productive for ten to fifteen years or more provided they receive appropriate management.

I have found that the first year or two is critical. For instance, Biloela buffel grass, lucerne and medic mixtures sown in January are allowed to seed (all species) and the crowns of the plants allowed to develop. It may be grazed lightly in the early winter of the first year. Lighten off and allow lucerne to flower and set seed again in October. If lucerne in a pasture mixture is allowed to seed in April-May and again in October-November, it has a chance of persisting, even on lighter soils, for four or five years. Every few years in appropriate seasons try to let the medics seed and replenish the medic seed bank in the soil.

Sown pastures may best be used to supplement native pastures during the winter months and again during stress periods in November to January, or to freshen up sale cattle in autumn prior to grazing oats crops.

It has been observed that all sown pasture species in use in this district respond to the same type of management.

Silk sorghum has responded in much the same way. One paddock of silk sorghum has been in use for seven years and in 1989 it is still productive though some patches of hard red country have reverted to Queensland bluegrass and medics. The paddock of 123 ha was allowed to seed in its first year and the seed was harvested. Thereafter, it has been grazed by yearling and/or two-year old steers during the autumn, winter and spring months at a beast to 1.5 to 2.5 ha. The paddock has been allowed to seed and reseed itself during the summer growing season when there has been adequate feed in the native or sown pasture paddocks.

Conclusion

My experience indicates that there are no hard or fast rules to pasture management. Perhaps it is an art based on observations and on an understanding of plant and animal behaviour and the effect of seasonal changes.

DROUGHT MANAGEMENT

Norm Fox Sr. and Chris Cooper

It has been said that there is a minor drought about every five years and a major drought about every ten years. These are of course generalisations, but the fact remains that dry spells and droughts do occur. They are a part of the Australian grazing environment.

Property development and animal management practices have been based on, or are at least significantly influenced by, climatic variability.

Management practices

On my property, stocking rates and grazing pressures are conservative rather than intensive. Stock watering points and subdivision have been undertaken to segregate categories of stock and ease the pressure during recurrent periods of stress. Provision for breeders, cows and calves, first-calf heifers, maiden heifers, weaners, steers and replacement heifers and for bulls has been made. For example, provision for a seasonal calving program is based on rainfall probability, so that a stock management calendar may be as follows:

September	-	Bulls to maiden heifers
	-	bulls vaccinated for *Vibriosis*
October	-	Bulls to remainder of breeding herd
	-	first branding
February	-	Bulls out and returned to bull paddock
	-	final branding
April	-	Weaning in yards
	-	weaners to weaner paddock
May	-	Pregnancy diagnosis
	-	empty and aged cows culled and remaining breeders vaccinated for *Leptospirosis*.

We aim for sound management practices and strive to have a property that is adequately watered, subdivided and improved so as to be in the best position to cope with drought conditions.

Without doubt, the most effective way to conserve fodder is as standing feed in the paddock. I offload stock by sale or agistment much earlier than in a normal season to conserve the grass crown or 'butt', thereby aiding quicker recovery. This may be in the form of spelled paddocks of native pasture, sown pasture or forage crops such as stand-over Silk sorghum. These are smaller paddocks or areas in addition to the normal grazing paddocks. In most years these will be a useful adjunct for the most vulnerable categories of stock, i.e. weaners, then first calf heifers (those with a calf at foot), then aged cows in calf.

In the present economic climate, as a dry spell develops into a drought, our practice has been to start to sell, lighten off and spread stock. At this stage, and if conditions deteriorate further, it seems that there are only four alternatives to selling. A combination of these strategies may also be used. Which way to go will depend on circumstances, both financial and physical.

Strategies

1. Sell all stock or reduce to nucleus herd. By investing the proceeds, some income from interest is obtained. Funds for restocking are then available when conditions improve. By

destocking, losses have been kept to a minimum and the land has been spelled, aiding quicker recovery.

2. Purchase another property in an unaffected area and move stock to this.

3. Seek agistment; agistment country can, and does often, let you down as the drought spreads, and you may be left with drought affected cattle far from home. Unforeseen management problems increase the further from home the cattle are agisted.

4. Supplementary feeding: molasses and urea, cotton seed and grain have been fed with varying degrees of success during the 1980s. There is a lot of written material available from the Queensland Department of Primary Industries on the subject. If your stock enterprise is more intensive in nature, you will have facilities for supplementary feeding such as grain storage, molasses storage, front-end loaders, hammermills, and other necessary equipment and supplementary feeding in the drought situation will have more appeal. Feeding conserved silage and hay is in this category. The dilemma lies in not knowing how long the feeding programme will be. It may be a few months or a couple of years. The feed bill can be very high.

Conclusions

Drought is part of our environment. The native pasture grasses have developed in this environment and for the better grasses to persist, they should be treated gently during the drought and while coming out of a drought.

Stock conservatively and sell! This conservative approach to drought management pays off in the long-term even though in certain circumstances it may prove to be, or seem to be, the wrong strategy. For instance, in 1989 when the summer rains had failed some paddocks were bare in March and it was decided to sell. Excellent rains fell in April, May and June. Pastures responded and by mid-June were in good shape, particularly in destocked paddocks.

WOODY WEED CONTROL

John Wood and Norm Fox Sr.

The information presented is derived from experience on the properties Taraba and Marrett.

Coolibah country

Taraba is 4440 ha situated 30 km south-west of Toobeah, with a 4 km frontage to the Macintyre River. It is a heavily flooded property. Records indicate that it receives an average of three small floods per year and a big flood every three years, but averages do not present a true picture. For example, during an 18 month period in 1983-84, the property experienced 15 floods.

Much country was ringbarked in early 1955 to satisfy lease requirements. As it happened, this was a dry year followed by a record wet year in 1956. The ground had been denuded of grass and the result was an incredible germination of coolibah seedlings. In 1968, when the Wood family moved to Taraba, the heavy black soil was covered by well-established coolibah seedlings in the most heavily flooded areas.

Initial treatment

Initial treatment consisted of further ringbarking of approximately 1200 hectares in 1969. This was in a dry year followed by record floods in late 1970 and early 1971. Another good establishment of coolibah seedlings resulted.

In 1972, 170 ha of some of the most heavily flooded and worst affected area was pulled and raked. This was ploughed over a period of five years and sown to barley and oats and eventually sorghum. Because of the severity of flooding, it soon became obvious that it was not an economic proposition to farm this area and in September 1981 it was planted to Bambatsi.

This was a particularly dry year, but as luck would have it, the planting was followed by a fall of 30 mm of rain. As well as the Bambatsi, this rain germinated a heavy crop of barnyard grass. This was controlled by the application of chemicals over about half the area. In 1982 there was a moderate flood (23 ft (7 m) at Goondiwindi), which covered the entire area sown to Bambatsi. This flood germinated a massive crop of coolibah seedlings. We found we could not plough the seedlings out or have sheep eat them out for fear of killing the established Bambatsi. We were advised not to spray chemicals because of potential damage to nearby cotton crops.

The situation at present is one of established Bambatsi with a dense cover of coolibah seedlings, 3 to 5 m high in this particular block.

In 1987, two small trial plots (20 m x 20 m) were spread by hand with Graslan® on country that had been rung in 1955. These were spread at a rate of 3 kg/ha and 5 kg/ha. The three kilo rate resulted in less than 10% killed while the five kilo rate was encouraging and resulted in 65% killed.

General comments

Woody weeds generally germinate in flooded country on a massive scale, therefore control can also be on a large scale if started early enough.

Woody weeds can be controlled if crash-grazed with sheep at an early stage, although this would be impossible to achieve in a period such as 1983-4 when, as mentioned before, there were 15 floods in 18 months.

We have found that Bambatsi is the only grass worth considering for controlling woody weeds in the heavily flooded country. No medic has been found to replace the native burr medic.

Bambatsi, when planted, should be planted into a well-prepared seed bed at a very shallow depth, preferably pressed into a shallow trench for maximum benefit from rain. The area is watched closely and if conditions are such that there is a good germination of coolibah seedlings, then the area is sprayed immediately.

Box-sandalwood-belah country

Marrett comprises 2150 ha situated about 50 km north of Goondiwindi.

Woody weed control and pasture improvement are two aspects of the same problem: most effective use of the property for animal production.

In this district the objective should be to achieve some balance in area between paddocks of improved native pasture, sown pasture and forage crops. There is considerable dependence on improved native pastures and these should be as productive as they can be made. Improved native pasture refers to grassland free of competition from timber or woody weed regrowth, except for shadelines.

Improved native pasture - establishment

Most of the country has been ringbarked or pulled at some time in the past. Box suckers, sandalwood and belah may be the major regrowth problems. There could also be patches of limebush or, in some areas, African boxthorn.

There are two approaches that we use, depending on the density of the regrowth and the amount of fallen timber present in a particular paddock.

Firstly, if we can move freely about the paddock, it is treated with chemicals to destroy the source of the regrowth (the roots and butts from which regrowth originates).

Secondly, when the ground debris or density of regrowth makes movement impractical, the area is stick-raked, burnt and the subsequent regrowth treated with chemicals. This follow-up treatment should commence as soon as the regrowth becomes visible above the grass. For a box sucker we apply three or four shots around the stump or sucker and about 0.7 to 1 m distant. It is important that the shot is placed on bare soil rather than on grass or fallen leaves. For sandalwood, belah or limebush, one or two shots are placed at the base of the plant where the stem emerges from the soil.

This method was used with reasonable success during 1979-89 at Marrett where almost 1225 ha of box-sandalwood-belah country were treated. In some paddocks it has been necessary to repeat the treatment two or three times as new regrowth appears. After the first burst of regrowth, each following treatment becomes progressively less demanding. The box is easy to control; the sandalwood and limebush less so.

It does not seem to matter in what season the chemical treatment is carried out. The chemical is leached into the root zone following the next rain.

New chemicals are now available for some of the more difficult species.

If the time involved and the cost of the chemical are looked on as a maintenance cost of the productivity of the paddock, then the effort is justified. As a guide, on one occasion in 1984, a 163 ha paddock was treated manually in ten hours over a three-day period. This paddock did not require treatment again until 1989.

Final action

When the native pasture paddocks have been stick-raked and the woody weed problem has been overcome, the paddock can be further improved by the introduction of medics (clovers in this district) and by strategic grazing management to favour the development of the more productive native grasses such as Queensland bluegrass.

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WAGGAMBA

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Looking to the future

GRAZING MANAGEMENT

Kim Felton-Taylor

The following is a discussion of experience of grazing management practices at Terella on two distinct soil-vegetation types. Both areas exhibited serious vegetative loss due to overgrazing by sheep.

Deep clay melonholes: brigalow country

The first area of interest is about 40 ha of deep clay melonholes. These melonholes were part of a 245 ha paddock. No pasture had grown on them for years because of the history of severe grazing pressure. The area supported only dog burr.

In 1972, most of the paddock in question was cleared and farmed for wheat. The bad area of melonholes was not fenced out or cleared. Consequently, the area was spelled from grazing for two years with only small numbers of cattle in the whole paddock for very short periods of time. After two years of almost complete spelling, Queensland bluegrass cover increased dramatically and medics increased during winter. The paddock is now grazed only by cattle and has a similar cover of feed as other paddocks which did not have the same overgrazed condition as the bad melonhole section.

Red box type soil

The other area of overgrazing was on red box type soil. This once was used as a holding paddock for the shearing shed. For a period of about ten years the shearing shed was used by three neighbouring properties. Therefore, large concentrations of sheep were on the holding paddock over three to four months of the year while shearing took place. This caused serious denuding of the soil. Large scalded areas were evident in the paddock. This was the only paddock that had been cleared on the property and was approximately 25 ha.

The paddock was ploughed and farmed in about 1974. Green panic was planted and let go to seed. This was harvested and the paddock was very lightly stocked until the following spring when it was renovated with lucerne points on a scarifier. The green panic was again let go to seed and harvested. A much thinner crop and a smaller amount of seed eventuated. The paddock has since been used as a horse paddock and occasional holding paddock for cattle. The green panic has all but gone except under trees. However, the scalded areas are now producing grass.

Regrowth of box, ironwood and appletree suckers has increased dramatically over the past five years and will soon have to be thinned in some areas with chemicals. There has been no evidence of scalding during the past twelve years. Overgrazed country can be brought back to normal productivity if allowed to regenerate and if time, effort and careful management are applied.

Present situation

This property ran sheep until 1972 and has since been used for cropping and cattle production. It has been pulled, and raking is still in progress. Areas of grazing country that were very sparse of feed from overgrazing by sheep have been spelled during summer where possible. This has resulted in a big increase in the bulk and productivity of grass and an increase of young trees in shadelines.

Lessons learned

As production is gradually changing from cropping to cattle, it is obvious that the shadelines will have to be protected. This will mean planting and fencing out areas of shade to let the small trees emerge and grow to a size where they cannot be damaged by cattle.

Paddocks that have been cleared later with more knowledge of stocking rates have 60 m wide shadelines around more parts of the paddock instead of one side only. These shadelines are coping quite well with stock.

Cattle allow regrowth to come quite readily in country that has been pulled and raked and farmed only for a short time. Shade areas are often inadequate, but this district is fortunate in that trees can be grown quite successfully in most soil types. Brigalow soils allow suckering particularly well and a thick area of suckers can be obtained in a few years if needed to give greater shade and wind protection.

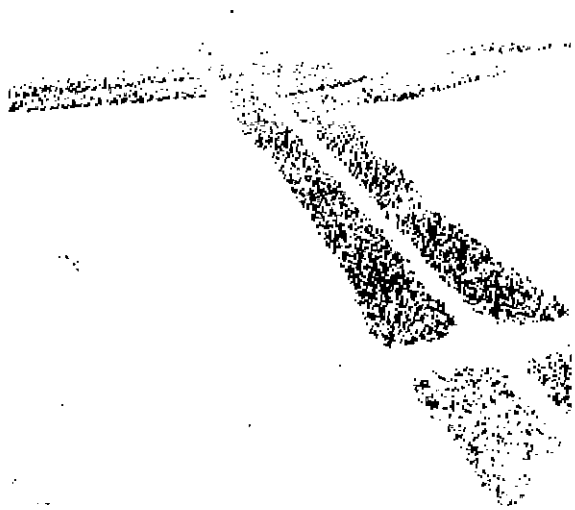
SHADELINES

Ron Ladner, Tom Durkin, Geoff Woods and Kim Felton-Taylor

The value of shadelines

The value of a shadeline cannot be fully appreciated until a serious look at re-establishing one from bare ground is contemplated. The dollar value of such a project is considerable, to say nothing of the work involved. Clearly, the value of existing stands of shadeline in Waggamba Shire is enormous. Before any country is pulled, positioning of shadelines should be taken into account.

Stock do better when provided with good shade and shelter as shadelines provide relief from high temperature and protection from winds. In addition to their aesthetic appeal, shadelines provide wildlife corridors and a micro-ecosystem for insects, reptiles and birds.



Recommended width

The desired width of shadelines varies with soil type and stocking densities. Vegetation in shadelines varies considerably with cropping and stock production. In brigalow-belah-wilga scrub country at Coorangy, shadelines are not stocked because of farming. Here, shadelines as narrow as 40 m have been sustained over a 25 year period. In more open country or country that has high stocking densities, shadelines of 100 m width are recommended.

Direction of shadelines

The prevailing winds in this area are north-easterly in summer and south-westerly in winter. Shadelines aligned in these directions are not useful as wind breaks. Shadelines running north-south and east-west are found to be most successful.

Ratio of shadelines

Depending on the location and layout of the property, remnant timber should occupy at least 10% of the total area. In cultivated areas, shadelines should divide blocks up into areas of 100 to 150 ha. Natural features may influence where timber is left, and a good farm plan is recommended to assist with decisions. Farm planning can identify the areas of greatest need for shadelines and provide assistance in making other farm management decisions.

Stock watering points

We have found that at stock watering points additional timber to that in the normal shadeline is desirable. Ideally, a belt of trees at least 100 to 150 m around the water should be retained. At these areas, where there is a concentration of stock, regeneration of trees may be suppressed or even eliminated. Some form of fencing is often required around areas where there is insufficient regeneration. This fencing can be carried out in sections on a rotational basis over several years to encourage establishment of new trees.

Risk factors to shadelines

Three of the greatest threats we have found to remnant timber are fire, spray drift and stocking. Stocking generally reduces the fire risk but in some circumstances, physical fire breaks may be required.

The greatest spray drift risk is from aerial spraying but substantial damage has also been caused by ground rigs. If spraying is carried out strictly according to recommendations, the risk of damage to shadelines is virtually eliminated. Ground spraying is easier to manage from the point of view of lowering potential damage. The booklet, *Herbicide application guidelines*, produced by the Waggamba Conservation Committee, contains more detailed spraying information.

Heavy stocking rates on cultivation under rotation with oats and pasture results in a large concentration of stock using shadelines. A decline of young trees and actual destruction of small trees due to stock rubbing and eating them often eventuates.

Reasons for shadelines

Strips of timber, or shadelines, are the only way to maintain trees. We have found that isolated trees, particularly in country that is regularly farmed, eventually die out and are not replaced naturally. Also, individual trees are much more of a hazard to farming operations.

In our experience, clumps of timber as opposed to strips are sustainable if they are at least 2 ha. They do not provide wildlife corridors. Clumps do not lend themselves to control of feral pests as readily as do shadelines due to reduced access into the trees to remove the pests.

We have found that in hilly country where areas are being cultivated, the hills or jump-ups should not be pulled. Adequate protection cover needs to be left on the western and southern sides to prevent soil erosion. Timber on ridges also provides future protection against possible salinity problems on the lower cropping country at the bottom of the ridges.

Shadelines help stop wind erosion. Winds of 18 km/hr or more lift soil, starting the erosion process. The full wind strength after blowing over a shadeline does not hit the ground for a distance 25 times the height of the shadeline. For example, with a 10 m high shadeline, the wind is not at full strength again until 250 m out in the paddock.

Clearing

It can be difficult, when clearing, to leave timber in desired widths and direction, particularly when pulling thick scrub with two dozers and a chain.

Some form of marking, such as blazing trees with an axe, is necessary. The benefits of sustainable shadelines are truly worth the effort. Once the trees are down they are costly to replace. It is easier to leave too much timber on the initial clearing and then tidy up later.

More discussion on shadelines is provided in the chapter on Nature Conservation on Rural Properties in Part A of this manual.

TREE REGENERATION

Elaine Mulckey

An essential characteristic of natural, undisturbed ecosystems is balance. Unfortunately, the amount of shrubs, herbs and ground covers have been reduced or even eliminated in the woodland remnants on our property, Burloo. Tree decline, the main outcome of this problem, is mostly caused by:

- stock and vermin stripping bark, grazing seedlings and compacting soil;
- mistletoe; and
- overclearing.

These problems can be curtailed through management.

Ideally, trees should be retained in clumps. Isolated trees rarely survive. If possible they should be interlinked to provide corridors to enable wildlife to colonise from one area to another.

Some shadelines in the paddocks closest to our house and cattle yards have lost their undergrowth, necessary for regeneration. Some have lost the whole windbreak. We have used electric fencing to wholly or partially fence these areas to exclude stock. We hope to shift this fencing to other sites as each area regenerates.

When reclearing a pulled paddock we leave any newly grown trees that could be considered as shadelines or windbreaks. This is cheaper and less painstaking than replanting.

To replant bare areas we started by cultivating our oats paddock. We picked an area which would be a good windbreak then planted four rows of staggered trees, one medium height, two tall and one medium. Six paces were left between trees and four paces between rows. Each hole was dug with a mattock. A tree planter would have been easier and faster. The tree was planted and the soil well pressed down. A well was then built around each one. Each was then watered with ten litres of water and two armfuls of hay were placed around each, leaving the tree stems free of hay. A grow tube can be erected at this stage if required. The whole tree area was then fenced to exclude stock. Trees should be kept weed free for a 1 m radius to enable development of good root systems.

Eucalyptus trees can be grown from seed quite easily. Seeds are gathered from dry capsules, put into envelopes and left for a few days in a warm place. This seed is planted by sprinkling over a seed-raising mixture that has been placed into a polystyrene box, then covered with a sprinkle of more seed-raising mixture and kept moist. Each box should be named, but if the correct name is not known, then the box label should indicate where the seed was collected. By collecting some leaves, seed capsules and flowers and drying them, they can be later identified by the QDPI Forestry Service or Botany Branch.

When trees are around 25 to 40 mm in height, plant them out in individual containers in a mixture of one bag of potting mix to a half bag of sand. Leave the trees in containers until the seedlings are 150 to 170 mm in height, at which stage they can be planted out.

Trees already planted in different areas in Waggamba Shire are as follows (Note: Some grow faster than others):

Red Soils

Eucalyptus argophloia	western white gum, Chinchilla white gum
E. bakeri	Baker's mallee
E. burdettiana	Burdett gum
E. camaldulensis	river red gum
E. cambageana	Dawson gum, blackbutt
E. citriodora	lemon scented gum
E. cladocalyx	nana gum, dwarf sugar gum
E. foecunda	slender-leaf mallee
E. leucoxylon	yellow gum, white ironbark
E. macrocarpa	brown box
E. maculata	spotted gum
E. melliodora	yellow box, honey box
E. moluccana	gum-topped box, grey box
E. ocrophloia	yapunyah
E. playtpus	mort, round-leaved mort
E. salmonophloia	salmon gum
E. sideroxylon	red ironbark, mugga
E. stricklandi	Strickland gum
E. torquata	coral gum, Coolgardie gum
E. torelliana	cadaga, cadaghi
E. viridis	green mallee box

Black soils

Eucalyptus argophloia	western white gum
E. cambageana	Dawson gum
E. cladoclayx	nana gum, dwarf sugar gum
E. leucoxylon	yellow gum, white iron bark
E. maculata	spotted gum
E. meliodora	yellow box, honey box
E. ocrophloia	yapunyah
E. platypus	mort, round-leaved mort
E. salmonophloia	salmon gum
E. sideroxylon	red ironbark, mugga
E. stricklandi	Strickland gum
E. torquata	coral gum, Coolgardie gum
E. viridis	green mallee box

Sandy soils

Angophora spp.	
Eucalyptus acmenoides	white mahogany, yellow stringy bark
E. bakeri	Baker's mallee
E. brockwayi	Dundas mahogany
E. intertexta	forest gum
E. leucoxylon	yellow gum, white iron bark
E. macrocarpa	brown box
E. tessellaris	carbeen
E. torquata	coral gum, Coolgardie gum
E. viridis	green mallee box
Grevillia robusta	silky oak
Pittosporum spp.	

Western Australian eucalypts are a problem to establish, as they are prone to attack by borers.

Note: The Dalby Forestry Service can advise on what tree to plant on different soil types. They also have leaflets and books for more advice.

Further discussion on tree regeneration is provided in the chapter on Nature Conservation on Rural Properties in Part A of this manual.

PROPERTY PLANNING

Hugh Gloster

Introduction

Property planning is a MUST. Take a lesson from the old bull and the young bull: *Walk and do it properly and well!* Don't rush without a plan and finish with no finance and no farm.

A property that is well planned and well run makes more money and sustains production far longer than an unplanned, poorly run property. To achieve a sound property plan, experience shows that you need to know the property well. Information on soil types, direction and height of water flows, length of slopes and rainfall patterns is needed. Aerial photographs and local knowledge are most useful.

The property plan:

Step 1

Map the different classes of land based on vegetation type, soil type and slope.

Step 2

Draw in the physical features:

- natural drainage lines;
- main soil types;
- vegetation types;
- existing fences;
- present land use in each paddock;
- watering points;
- buildings;
- roads and tracks;
- cross road drainage.

Step 3

Prepare the proposed farm plan. Give consideration to areas that can be safely cleared.

There are several useful approaches to actually developing the plan of future farm operations, but the following summary by the Queensland Department of Primary Industries gives a good framework for practical planning:

The farm plan is produced to suit the land classification classes, the physical inventory and the desire of the farmer. The plan should show the necessary conservation practices to control runoff and erosion and to maintain and improve productivity.

The following aspects should receive detailed consideration in developing the farm plan :

- *The runoff disposal system must be coordinated in relation to surrounding farms, the overall catchment and public utilities such as roads and railways.*
- *The type of intended production must be considered in relation to the special requirements associated with it.*
- *The flexibility of the plan concerning its suitability for other forms of production if a change in owner interests or changing returns for farm commodities necessitates change.*
- *The ease and efficiency of working the property must be considered in relation to the particular needs of the type of production being undertaken.*
- *The most suitable system of erosion measures to be adopted on the various areas to gain maximum control of erosion and increased stable returns from the farm is a primary consideration.*
- *Access with farm machinery, stock movements, subdivision fencing and location of runoff disposal systems must be considered.*

The development of an effective soil conservation farm plan on a property generally requires a complete reorganisation of farm layout to suit the topography. Only permanent improvements such as farm buildings and permanent watering points are therefore considered when the plan is being developed.

While the location of existing fences should not be discarded completely from consideration, there are few farms where the existing location is ideally suited for soil conservation development and, generally speaking, location of existing fences should not be allowed to influence the layout.

Anecdotal information - the Rugby experience

Unfortunately, it takes time to know a property sufficiently well to make a 'perfect' property plan and few people can afford the luxury of waiting before they utilise the property. I have found property planning to be something that changes and grows with my experience of farming techniques and understanding of the country My experience shows that a property plan needs to be adaptable to changes in financial and political situations which cannot be foreseen. An economic farming proposition one year can be uneconomic the next with changes in government policy or world markets These factors make long-term property planning very difficult.

The initial plan after purchasing Rugby in 1977 was earning an income from cash cropping and cattle. A plan of the property had been drawn up showing existing and proposed fencing and watering points to subdivide the property into approximately 120 ha paddocks with smaller paddocks around the cattle yards which were sited in the centre of the property. Water was supplied through 50 mm poly-pipe linking a flowing artesian bore to concrete tanks. These tanks supply water to four adjoining paddocks. Shadelines had been retained around the northern end of the property, with single trees and the odd clump in some paddocks.

Our aim was to develop the land to its full potential. This meant raking the cleared timber and controlling the limebush growth. We did this on a paddock by paddock basis, raking limebush and pulled timber, leaving trees and tree clumps and farming to control limebush regrowth. This way we could breed cattle on the undeveloped land and pay for the development with farming. Our plan at this stage was to farm for seven years to control regrowth and then repasture for cattle production.

After seven years, cattle were not very profitable and farming on some of our soils was more profitable than grazing. At this stage we decided that a combination of farming and grazing would complement each other. Since then we have made a property plan in conjunction with the QDPI to build flat-bottomed, grassed waterways and contour banks on our more sloping land. This enables us to continue farming our better soils and maintain a viable farming enterprise.

To carry out the property plan we have had to remove some existing fences and replace them in a more appropriate position to suit the development. With a change to zero tillage techniques we have gone to farm-over contour banks which are further apart than our initially planned banks. We have been able to do this because we have less runoff due to stubble retention, and better water absorption of the soil due to a crop rotation of taprooted and other crops.

The property plan is being developed as time and finance permit to enable us to run a mixed farming-grazing operation to its fullest potential.

SITING OF IMPROVEMENTS

Geoff Woods

Buildings

At Coorangy, the site of the homestead and, therefore, the power line were determined by previous management. The site of the homestead in 1934 was no doubt chosen because of the available access, freedom from floodwater, aesthetic considerations and availability of water. It happened to be close to the north-west corner of the holding. However, the purchase of the neighbouring property 14 years ago has now made it central.

The original choice of the homestead location has heavily influenced the siting of further grainsheds and workshop. The grainsheds were built about 200 m to the south-west of the house. I have found that distance to be only just adequate. The problems of voltage loss (proportional to distance from the transformer) influenced this decision. The prevailing north-east winds in summer assist in reducing noise and dust levels to the homestead during the harvest period.

The workshop was built further around to the south, screened behind a clump of timber for aesthetic reasons. The siting of the workshop is quite satisfactory, being reasonably handy to the house and yet physically separated. Having all the buildings reasonably close to each other has meant that all can be serviced by the one all-weather road. The road is sited so that out-of-hours traffic can be observed from the homestead.

Yards

My cattle yards are located about 500 m south-west of the house, behind the grain sheds. This enables me to use the same all-weather access road and also use the same reticulated water facilities. I have arranged the fencing to facilitate access for the stock and to have two 40 ha paddocks available for holding cattle near the yards for a couple of days when necessary.

The location is central, with all paddocks being within 4 km of the yards. The area is reasonably well drained, adjacent to the workshop and storage area and still handy to the house.

Fencing

As was the case with the siting of the homestead, most of the fences were in place prior to my management. Most of the subdivisional fences are in shadelines, providing shelter on both sides of the fences. This does cause extra fencing repairs after wind storms but I value the shelter on all sides of the paddocks. Where fences are sited on one side of a shadeline and there is little shade in the paddock, I hope to plant trees about 25 m out from the fence to provide shelter for stock.

The next major review of fencelines will be at the completion of extensive soil conservation works in a few years time. It is likely that a number of fences will be removed and new ones built to conform with the new property plan incorporating the soil conservation works and better thoroughfares for moving stock.

Watering facilities

All the watering facilities on my property are excavated tanks on waterways and gullies. They have been sited centrally in a paddock or at times adjacent to where several paddocks meet, to provide water to several paddocks from one site. Dams or troughs should not be placed right against paddock corners, particularly on boundary fences because of the likelihood of fence damage from cattle.

As there are several watercourses through the property, site selection for water facilities is determined by placing the water strategically in relation to the feed. It should be taken into account that the watering facilities will create high stocking pressures on adjacent fencelines and natural features. I prefer to have plenty of shade available near watering points as I believe the shade reduces stress on stock during hot weather.

Roads

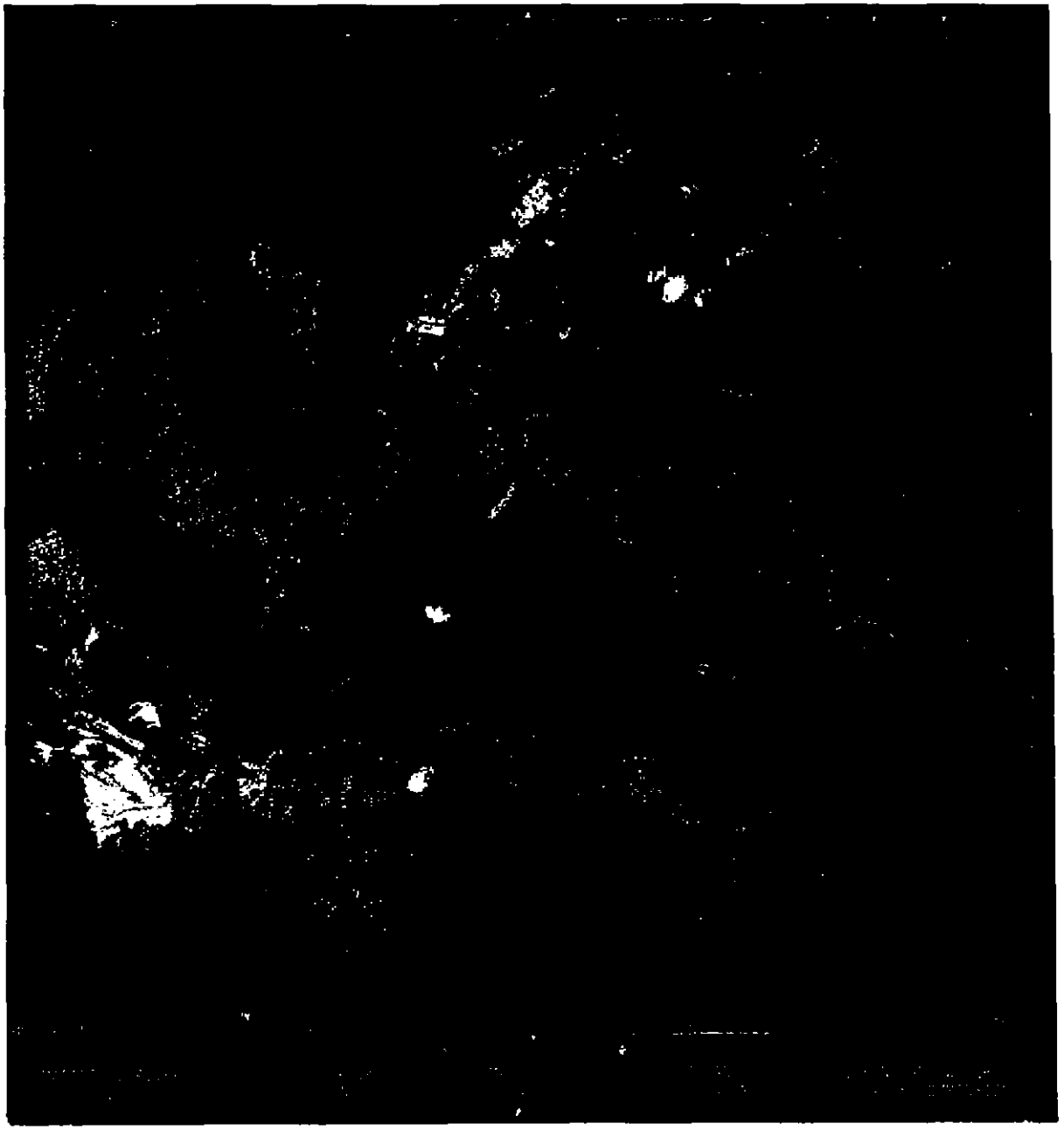
Farm roads are usually sited along fence lines, shadelines, levee banks or along natural features such as ridges or creeks.

There are many practical reasons for determining where internal roads should be. One of the main

considerations should be whether the road is inclined to adversely affect the natural flow of water, particularly if the road is formed.

I have found that since the construction of waterways, a formed road along the outside bank of the waterway to be suitable in some of my paddocks. The formation has a slight fall away from the base of the waterway bank so water is not ponded between the base of the bank and the roadway.

A well-designed internal road network can add to the efficiency of the property, particularly in farming operations. As with the siting of all farm improvements, the use of a good farm plan (preferably using aerial photos) is essential.



MANAGEMENT OF MELONHOLES

Geoff Woods

In 1976, I purchased Venture Downs which included an area of severe melonholes. The country had been pulled and was used for cattle grazing. The feed was poor. There were scalded areas of heavy, hard crusting clay with a good growth of dog burr on the edges of the holes and large patches of cane grass in many of the larger holes. In addition, stunted brigalow suckers, box and mountain coolibah suckers were well interspersed throughout.

Clearing

I burnt the paddock as well as possible, considering the lack of grass for fuel. The country was then raked and hydraulic harrows were used in the final stick-picking operation. I hired a D7 to rip out hundreds of large stumps. Getting the sticks off the country was a slow and expensive operation.

Levelling

After the country had been disc ploughed once and chisel ploughed twice, a land leveller made from local timber was used to take the sharper edges off the melonholes. It was impractical to try to level the land as many of the holes were almost two metres deep. Altogether, the leveller was used over the paddock three times. I could see little purpose in further levelling attempts.

Farming

The paddock was then put down to wheat for five years and sorghum for two years. The productivity was poor and it became apparent that there was not much future in trying to grow cash crops. Sorghum was a better proposition than wheat as the plant is sturdier and the sorghum held up better if harvesting was delayed by wet weather.

On a number of occasions heavy rains were received either just prior to planting or at harvest, filling the melonholes with water and creating major problems for the movement of machinery. The paddock tended to receive less priority due to its lower potential productivity. The farming did eradicate the suckers and tended to smooth out the melonholes further.

Pasture establishment

Half the paddock was planted with purple pigeon grass and the other half with Bambatsi panic on 30 September 1988. It was done this way with the hope of harvesting some seed at a later date. Although the soil was moist at the time of sowing, only about 5 to 10% of the purple pigeon grass struck. None of the Bambatsi panic germinated as it was sown virtually on top of the ground. The seed was treated to reduce ant theft.

No falls of rain exceeding 35 mm were received during the next six months. The purple pigeon grass still managed to establish quite well with about 50% ground cover. The Bambatsi panic was still almost non-existent.

Good rains in April 1989, 138 mm in five falls, really got the purple pigeon grass going but the Bambatsi panic strike was still poor. It was not until the showery weather in October-November 1989, that the Bambatsi panic started to make a worthwhile start. Further rain in March 1990 has finally led me to decide not to plough the area sown to Bambatsi panic. This paddock now has a much higher carrying capacity than it had originally.

In April 1990, I planted the adjoining paddock which has similar melonholes and runs up to a box and ironbark ridge. I used a shotgun mix of snail, cyprus and parragio medics, trifecta lucerne, together with purple pigeon grass and Bambatsi panic. I also planted wheat as a cover crop. The medics and lucerne have grown well during the winter and, hopefully, the grasses will come away in the summer.

Summary

I believe care should be exercised when levelling melonhole country. If the topsoil is shallow, the underlying clay can be exposed, creating permanent bare patches.

It is necessary to control sucker regrowth in some way. Blade ploughs can be used as an alternative to chemical control which may prove more expensive. I believe severe melonhole country is better suited to grazing rather than permanent farming.

DEVELOPING MELONHOLE COUNTRY

Hugh McMicking

Before embarking on developing some melonhole country, I enquired of an old hand his best strategy for the program. His forthright reply was "Sell!" In hindsight he had some wisdom.

Cropping or pastures ?

I have attempted to grow grain crops on this type of country after significant expense in levelling the melonholes. This has resulted in much frustration and varying yields. I found that I could only budget on three crops in each five-year period. Failures were mainly due to waterlogging at sowing or harvesting or both.

My greatest pleasure with melonhole country is to drive about a paddock with livestock standing belly-deep in forage crops or improved pasture. This form of utilising the resource is more secure and reliable than cash cropping, and you don't have to wait for the ducks and water to vacate the melonholes before the combine harvesters move in.

Development methods

Development has taken two approaches. There is the *whole hog* approach - rake, plough either with offset or blade plough, build up the moisture profile, and then sow forage crops or permanent pasture or both. I have found it takes two or three years to plough out brigalow suckers and limebush using medium-weight offsets.

The other, less costly, method is to shut the country up and burn when there is sufficient fuel. This is followed up with aerial sowing. I have had good establishment with Silk sorghum and medics, and have seen excellent stands of purple pigeon grass, green panic and Bambatsi panic using this method. Ant treatment of the seed is a must.

Conclusion

Any development program must weigh up the costs versus the benefits and melonhole country is no exception. The woody weeds must be removed and the method used will vary with individual needs. I have greater peace of mind with the least-cost method.

BEEKEEPING

John Sloss

Beekeeping is a significant land use which is often overlooked. It is probably the best example of a primary industry that does not degrade the ecosystem. Beekeeping operations do not compete with other primary industries and in some cases are beneficial and complementary.

Value to agriculture

The total value of Australian honey production is $50 million per year. However, agricultural crop yield increases attributable to incidental, deliberate or feral honeybee pollination have been valued at $1 billion annually. This, added to the combined value of the products of the hive, honey, pollen, propolis and royal jelly, makes beekeeping one of the most significant primary industries in Australia.

Many plants, such as lucerne, sunflowers, cucurbits, some fruit and nut trees and others are dependent on honeybees for pollination and satisfactory seed-set. A total of 77 different types of crops in Australia have yield increases due to honeybee pollination. Twenty seven of these crops are economically important.

Important honey sources

Australian eucalypt forests are capable of producing large crops of uniquely flavoured honeys. The ironbark, box and gum families are well represented in Waggamba Shire. This resource has been depleted by ringbarking and, latterly, by bulldozers and herbicides. The timbered areas are sometimes replaced by crops such as lucerne and cotton which can be good nectar producers but the use of insecticides and herbicides makes agricultural areas less attractive to beekeepers.

Eucalypts from which beekeepers can produce major honey crops in the shire are:

Eucalyptus microtheca	coolibah
E. crebra	narrow leaved ironbark
E. camaldulensis	river red gum
E. fibrosa nubila	blue-topped ironbark
E. pilligaensis	mallee box (or gum topped box)
E. largiflorens	black box

Coolibah, one of Australia's major producers of choice quality honey, is threatened with reduced significance as a honey producer because of large scale clearing of flood plains for agricultural development.

River red gums have flowered heavily but have yielded no nectar for over six years since a mysterious malady has affected them. The worst affected trees have died and many are very sick, but the first sign that something is wrong is that they fail to yield nectar under conditions when they would otherwise do so. The ironbarks and mallee box in the forestry areas are not currently under threat.

Some of the eucalypts, acacias and numerous other trees, shrubs, herbages, crops and weeds are the main sources of pollen within the shire.

Problems

Floods, ants and bee disease can create problems within the shire. However, bee-eating birds and cane toads do not present the problems here that they do in other areas.

Industry future

There are few commercial beekeepers with their operations based in Waggamba Shire, although there are many hobbyists. When conditions are favourable, numerous migratory beekeepers move thousands of hives into the shire to take advantage of heavy honey flows, especially in state forests in the northern part of the shire and in the flood-prone country in the west.

The size of the investment required to make a reasonable living in the beekeeping industry is somewhat smaller than that required for most other primary industries in the shire. Lack of knowledge, aversion to bee-stings and the uncertainty of producing regular crops deter people from entering the industry.

New and better roads, forestry tracks and fire breaks have improved the accessibility of apiary sites in the shire in recent years. Future conditions are likely to dictate that there will be a shift in beekeeping activity from honey production to pollination services.

Formal education in the field of beekeeping is available from a number of institutions and employment for qualified beekeepers is readily obtainable.

Other plants in Waggamba Shire useful to honey bees include:

Scientific name	Common name
Acacia aneura	mulga
A. decora	pretty wattle
A. harpophylla	brigalow
A. pendula	myall
A. salicina	doolan
Angophora costata	cabbage gum or rusty gum
A. floribunda	rough-barked (or roughbark) apple
Atalaya hemiglauca	whitewood
Atriplex spp.	saltbushes
Bidens pilosa	cobbler's pegs
Brachychiton populneus	kurrajong
Brassica spp.	canola
Capparis mitchellii	bumble tree or wild orange
Casuarina cunninghamii	river oak
C. cristata	belah
Centaurea solstitialis	St Barnaby's thistle
Citrus spp.	citrus trees
Cucurbita maxima	pumpkin
Cynodon dactylon	couch grass
Eremocitrus glauca	limebush
Eremophila mitchellii	false sandalwood or budda
Eucalyptus conica	fuzzy box
E. dealbata	tumbledown gum
E. intersecta	gum barked coolibah
E. melanophloia	silver leaved ironbark
E. panda	corky ironbark
E. polycarpa	inland or long fruited bloodwood
E. populnea	poplar box
E. tessellaris	carbeen
E. tereticornis	Queensland blue gum
E. viridis	green mallee box
Flindersia maculosa	leopard wood
Geijera parviflora	wilga
Glossypium hirsutum	cotton
Grevillea striata	beefwood
Helianthus annuus	sunflower
Heterodendrum oleifolium	boonaree
Lycium ferocissimum	boxthorn
Medicago sativa	lucerne
Melaleuca lanceolata	western tea-tree
M. linariifolia	river tea-tree
Muehlenbeckia cunninghamii	lignum
Myoporum deserti	ellengowan
Phyla nodiflora	carpet weed
Sorghum spp.	sorghum
Rapistrum rugosum	turnip weed
Salvia reflexa	mintweed
Salix babylonica	weeping willow
Sclerolaena muricata	prickly roly-poly
Schinus areira	pepperina
Tamarix aphylla	athel tree
Tribulus terrestris	caltrops
Verbesina encelioides	crownbeard
Xanthium spinosum	Bathurst burr

CONTROL OF PESTS

Gavin Lahey and Hugh McMicking

Kangaroos, feral pigs, wild dogs and dingoes are all considered pests in Waggamba Shire. Methods for controlling these animals vary but electric fences and baiting for feral pigs appear to be the most successful and economic long-term control.

The problems

This article refers mostly to mixed country on Quomera where grazing and cropping land adjoins forest country with extensive areas of timber providing a refuge for kangaroos. Settling this country created permanent water points and more feed, particularly winter feed and crops. Kangaroos can have a devastating effect on crops, and they also tend to congregate in paddocks spelled for special needs such as drought.

In the late 1960s and the 1970s, Department of Forestry operations in the shire ringbarked existing timber to encourage the growth of cypress pine. This created grass through the forest country, resulting in an increase in kangaroo numbers. In 1972, kangaroo exports were prohibited and have been controlled ever since. Numbers seemed to explode until nature culled them heavily in the severe drought of 1980/81.

Control strategies

By the mid 1980s, some landholders sought to fence out kangaroos, this being done by reconditioning old 6 ft (1.8 m) netting fences and erecting an electric wire parallel to the fence 200 to 250 mm from ground level and offset by 200 to 250 mm.

This tends to deflect the animal before it can traverse the fence. Though kangaroos remained on both sides of the fence, the effect has been to prevent the annual winter invasion of kangaroos into crops and pastures.

Reconditioning of fences for electrification is labour intensive as netting needs to be patched and secured at ground level. Some 50 year-old fences were so well built they can be used with minimal material cost.

New fences constructed using hardwood posts or droppers or both can be electrified commencing with a live wire 100 to 150 mm above the ground and alternating upwards with the earth wires. These fences are self-insulating and easy to electrify.

Regular patrols are necessary, particularly in the early stages. A common problem is kangaroos inside, pushing the netting out against the electric wire. Timber and weed regrowth commonly occur alongside and through the netting. Failure of all electric fences is caused by loose wires shorting out. Provided upkeep is maintained, this type of fence has proved effective against feral pigs and wild dogs.

On Manus, feral pigs are best controlled by baiting. Both carcass and grain may be used, though there is always a risk of domestic animals taking carcass baits. Using rotten, poisoned grain buried at a shallow depth targets feral pigs without threatening domestic animals or birds.

FLOOD PLAIN MANAGEMENT ON BOOLARWELL AND GLENTOWN

Bill Turner and Richie Donovan

Boolarwell is a wool producing property of about 8100 ha, 76 km west of Goondiwindi. Most of the property is subjected to flooding by the Weir and Macintyre-Barwon River system.

Glentown is approximately 4000 ha made up of heavily flooded coolibah country, slightly higher box-type country and loam ridge, situated 50 km west of Goondiwindi, approximately 6 km from the Macintyre River. Callandoon Creek, which is an anabranch of the Macintyre River, runs through the property for approximately 8 km.

Flood measurements

Expected height and time of peak of the Macintyre River at Goondiwindi Bridge is vital, as this information gives an indication of what to expect and when to move stock. Flooding occurs at Boolarwell when the Macintyre (Barwon) reaches 23 ft (7 m) (Goondiwindi gauge). Flood levels of up to 28 ft (8.5 m) are considered beneficial and even desirable during summer. A 28 ft flood would inundate about 1600 to 2000 hectares. A Macintyre River flood of 30 ft (9 m) (Goondiwindi gauge) is a major flood at Boolarwell.

At Glentown 12 to 14 ft ($\approx$ 4 m) gives a run-through in Callandoon Creek. Flooding of country occurs from 18 ft (5.5 m) upwards. Minor flooding from 18 to 23 ft (5.5 to 7 m) floods up to 1200 hectares, leaving sufficient area for safety and grazing.

Sheep can be moved in front of the water to higher ground and left in their paddocks once water has passed. If mustered too early, sheep walk back and can become stranded. Rises of 28 to 30 ft (8.5 to 9 m) involves considerably more work as sheep have to be entirely mustered out of lower paddocks to higher country. Approximately 2800 hectares are flooded at this height. In a major flood of 30 ft (9 m) all stock are moved to high knobs of country leaving very small areas for sheep to feed. Floods over 30 ft (9 m) leave about 8 ha out of water. Hand feeding or hay drops are then necessary as it is only possible to reach some of the sheep by horse or boat.

Flood effects

The floodwaters take from five to ten days to flow from Goondiwindi to Talwood, depending on whether the river is 'wet' or 'dry' and on the density of grass on the flood plain.

All summer floods up to 28 ft (8.5 m) are beneficial and such a flood will provide as much as two years' feed if managed properly. The grasses that grow following summer flooding can become rank and need to be crash-grazed for short periods to prevent this. Summer rains can provide good feed if they fall at the right time but floods are really essential for this country.

Winter floods are a disadvantage to graziers on the floodplain. The flood waters and consequent waterlogging drown the winter herbage. Also the ground does not dry out quickly thus restricting access and making boggy conditions for stock. The drowning of feed and the cold and boggy conditions can lead to sheep losses through starvation more than actual drowning of sheep. Hay drops are more likely to be needed during winter floods.

At Boolarwell, five flood bridges have been built to help with the movement of stock. The movement of stock prior to flooding needs planning. If the stock are moved to the high ground too soon the feed will run out on the safe areas. The best strategy is to feed the sheep out slowly just in front of the floodwaters.

Sheep management

Conditions at the time of flooding play a big role in management. Full-wool sheep and lambing ewes need constant attention. For example, in the 1988 March-April floods at Glentown, sheep were full-woolled and not able to be brought to the yards. They had to be caught and dressed for flystrike daily. Conditions at the time were very humid and rainy - ideal for blowfly.

Most times after major floods, drenching is essential because of heavy stocking of small areas and the first feed being high in water content.

At Glentown, Richie Donovan uses flood yards, which are fenced areas of high ground suitable to hold sheep until the water peaks or starts to drop. On many occasions it is a matter of man, oilskin, horse and dog; meaning you have to be prepared to move or check sheep at any time under any conditions.

Woody weeds and regrowth problems

Woody weeds and regrowth are a problem on the floodplain. Belah and coolibah trees tend to regrow if ringbarked, so poisoning is better. At Boolarwell, we have found Tordon® to be best on belah and Velpar® best on coolibah. Treatment is best at midsummer when the sap flow is at its maximum. The belah needs to be cut right around with a tomahawk and the Tordon® brushed on immediately. The coolibah needs a cut every 10 cm with Velpar® injected from a syringe. Black wattle can be controlled with either chemical. When the sap flow is good, Bill Turner says he can actually hear the tree draw in the chemical!

It takes about twelve months for the trees to die even though the belah trees can be seen wilting within twelve hours of treatment. The grass starts to respond near the tree almost immediately. About 4000 hectares of Boolarwell have been treated in the past ten years. Timber treatment is a job that needs attention each year.

Lignum bush can be controlled with Graslan® at a cost of about 10c a bush when applied on the ground. The main disadvantage of using aerial application is that it is non-selective, killing all trees in the treatment area. The lignum is getting thicker. It may be because of increased stocking pressures during dry times, but Bill Turner knows of one area that hasn't been stocked for years and yet the lignum has completely overgrown the area.

Fire can be used to control lignum and regrowth if you can get good summer seasons to provide enough fuel and to regenerate the feed afterwards. Where lignum is thick, the grass tends to be thin and so does not provide enough fuel to burn satisfactorily.

At Boolarwell, when we treat timber we are careful to leave shade clumps. We like to have at least one shade clump to each 160 hectares. These clumps do not tend to spread as the sheep congregate in them and control the regrowth. Sheep do not gather under isolated trees and so the tree tends to spread seedlings. These clumps are of benefit at mating time or for supplementary feeding because the sheep population is concentrated and accessible.

Feral pests

Kangaroos are not much of a problem on the floodplain. They tend to be attracted to the cropping areas. Pigs and foxes are a problem and these are shot and poisoned all year round.

Fencing

Fencing is largely determined by the flow of the various waterways. Generally the floodwater is not fast-moving and does not damage the fences much. In years gone by, the netting used for rabbit fences collected debris and tended to wash down, particularly after a dry time. Bill Turner buys in timber for fencing. Box, sandalwood and yarran are the preferred timber. Steel posts are also good and last about thirty years in this country. Split belah was used but there are none left to cut now.

Roads

Access roads are usually along sandalwood ridges and river banks which tend to be a little higher than surrounding terrain. Access is always very restricted during floods.

Land improvements

There are only five dams on Boolarwell as most paddocks are watered by rivers and creeks. There is no erosion in this country apart from areas on the river banks.

Changes have been noticed in recent years due to clearing and levee bank construction. Future development of levee banks along this flood plain could create deeper and faster flowing water causing changes in present management and viability. This could also lead to a reduction in the number of small, currently beneficial floods.

With the enormous changes now taking place in the Macintyre-Barwon floodplain, all previous information on heights and speed of flow must be continually updated and recorded.

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FLOODPLAIN PROPERTY MANAGEMENT

David Venz

Though development on the flood plain is very similar to that on adjacent areas, the coolibah soil and constant threat of flood inundation present challenges. Every management plan must allow for interruptions of weeks of flooding at any time of the year.

Planning

Development needs careful planning to ensure all steps are done correctly first time. The resources of the property must be identified and mapped as the first priority.

On the floodplain, land levels are both vitally important and deceptively subtle. The most accurate way to identify the resources of a property is a grid survey of levels. It is suggested that the survey be more intensive across the direction of flow (at least every 50 m) than with the flow (200 m). This may still not tell the full story as flooding is complex and variable over these large areas. Much can be learnt from knowledge of the local plants and experience of floods. Using all information available, maps need to be drawn showing watercourses, swamps, sandy ridges and powerlines.

When soil types are added to this map, the owner is in a good position to identify areas suitable for various land uses.

Identifying land use capability

Trees are the most visible indicators of soil types and also indicate the flood regime of an area. The major trees and some pertinent points are as follows:

- River red gum and tea-tree - usually along the major water courses.
- Coolibah forest - the most reliable farming soils but they present establishment difficulties. May be subject to flooding.
- Brigalow and myall - rarely flooded, soft,friable soils.
- Black wattle - low lying, frequently flooded, soft, friable soils.
- Nardoo-swampgrass - frequently flooded areas.
- Poplar box - loamy ridges, mostly flood free, undesirable for farming, reasonable grazing.
- Whitewood, sandalwood, emu-apple - as for box.
- Carbeen - pockets of deep sandy loam soils.
- Cypress - unfertile sands, unsuitable for cultivation, poor grazing potential.

As most of the soils are alluvial, the surface deposits may be shallow and not a true indication of the potential.

Areas which remain underwater for long periods (more than two days inundated) will be of limited agricultural use, depending on the frequency of the floods.

Regrowth after clearing will be from seedlings not suckers. The potential of flooded areas to be densely reseeded cannot be over-emphasised. Currently available herbicides are as expensive as clearing mechanically. They have the disadvantage of leaving the land littered with timber but are used where they best suit.

Earthworks

Roads

Roads should be formed with shallow batters and to a minimum height. Without due care they will divert water causing erosion and ponding. Floodways need to have gravelled inverts to allow traffic while water is still draining. Small steel pipes are used in persistently wet areas, but the large volumes cause most of the water to go over the roads.

Levee banks are a good site for roads but are narrow and dangerous, especially when wet.

Levee banks

Levees are used to prevent water entering important areas such as house and shed areas or valuable cropping land. Provision for the removal of storm water needs to be made for all levees.

Levee banks may have far-reaching effects around the property and off it, because they divert water. For this reason their construction is regulated by the relevant government body.

The protection of crops by levee banks is of paramount importance to the viability of individual farms. Financial institutions should bear this in mind when financing properties on the floodplain.

Stock watering points

While the floodplain can be saturated in flood times, it can dry out surprisingly quickly. Dry spells on the floodplain can be as severe as in other areas of the shire. Therefore, stock water will be required in blocks not adjacent to permanent water. Earth tanks are widely used and are designed for flood filling. Shortfalls in supply are met by pumping across land from permanent holes. Very little bore water is used.

Irrigation storages

Siting of a storage is important to the efficiency of an irrigation farm. This can be a complex issue involving:

- the need for recycling irrigation and storm water;
- suitable soil type for a storage;
- relative reliance on water harvesting versus allocation;
- natural slopes and levels;
- any future development; and
- the availability of capital.

Due to the importance of storages and large capital costs, specialists are relied upon for design assistance.

Grazing management

Pastures

Native grasses make quite good pastures. The most desirable improved grass is Bambatsi panic, as it is tolerant to flooding and successful out of the flood waters on the dark coolibah soils. Purple pigeon grass and Silk sorghum are used in the better soils above the floods but are recognised as being short lived. Buffel grass is a favourite on the lighter, box soils.

Common burr medics are quite widespread in the native pastures. They are valuable in seasons that suit them. Lucerne performs quite well in the ley pastures but will not withstand regular flooding.

Sheep

Sheep are seen as less desirable than cattle on the floodplain because they need to be moved away from rising water. However, they are useful for control of timber seedlings.

Cattle

Brahman crossbreds are seen as desirable on the floodplain because they withstand the harsh conditions of alternately very wet and very dry periods.

Cattle represent the enterprise least affected by flooding. Very few cattle have been lost by flooding. They walk out of the floods to high ground if the fencing allows them. They do require somewhere above high water to rest or they suffer severe foot problems. If feed is available cattle will feed into water. Herds should be treated for *Leptospirosis* annually.

Raingrown dryland cropping

Wheat is, historically, the most satisfactory crop. Special varietal selection is based on resistance to crown rot and the ability to stand should floodwaters occur near to harvest time.

Coolibah soil is coarse and presents seed establishment problems, as it does not close over the seed with conventional planting equipment. Press-wheels are an improvement, but field rollers are much favoured.

Aerial sowing is a less favoured option and should only be attempted in emergencies. Plant growth is restricted because the crown of the plant is not covered and secondary roots do not develop properly. This leads to poor tillering and lower protein because the poor root system cannot use soil nutrients. A better option may be to plant a month later using conventional planting equipment.

Dry sowing is shallow planting into dry topsoil. While not preferred, it is commonly very successful.

Although residual herbicides work well, there is some danger in treating paddocks before planting as flooding may cause lengthy delays. Hence, a paddock intended for winter cropping may end up being left for a summer crop, provided this is not restricted by the previous application of a residual herbicide.

Irrigated cropping

The soils and climate of the floodplain are suitable for an extensive range of crops. By virtue of its low slopes and high water holding capacity soils, the flood plain lends itself to flood irrigation. Other methods are not usually practiced.

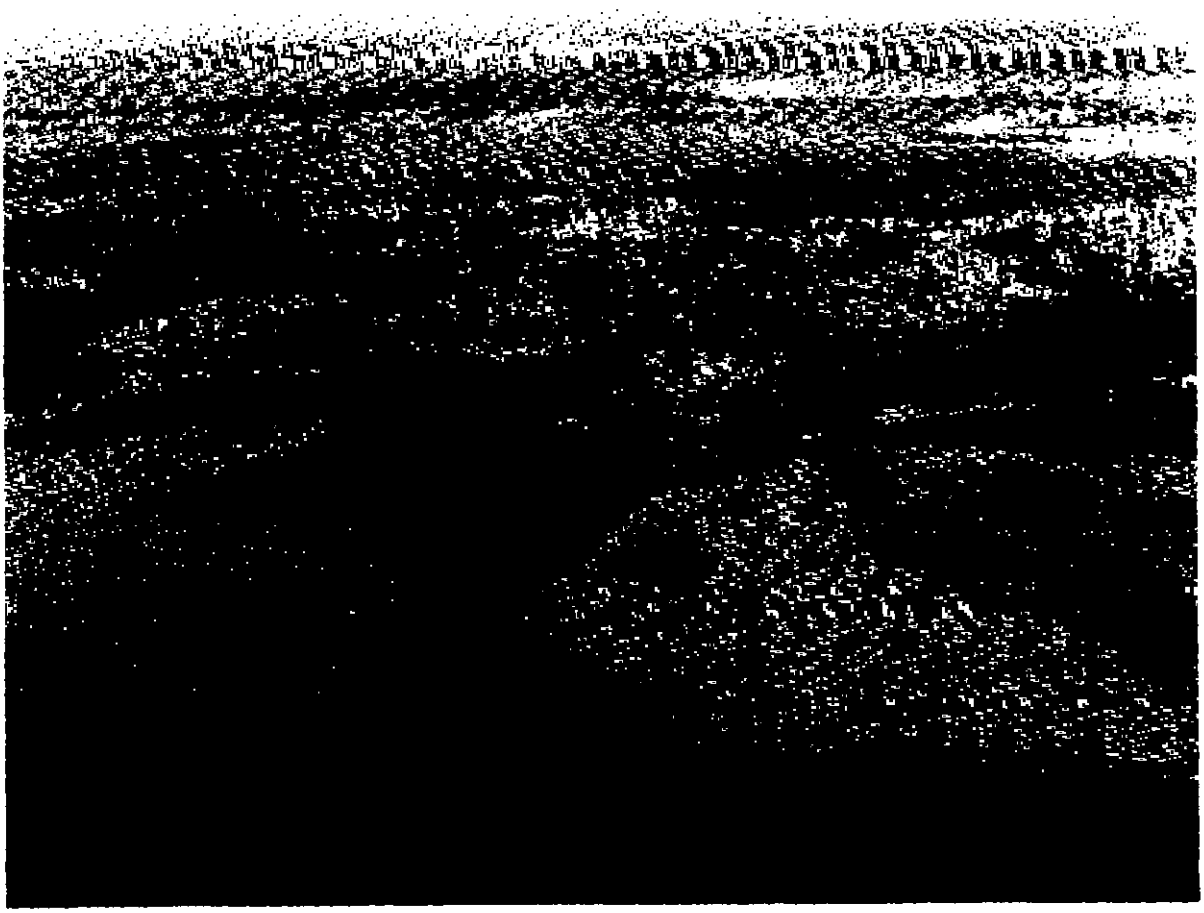
Low relative profitability makes grain and forage crops less attractive. Where grain crops are grown, on-farm storage of the harvest may be necessary when access for trucks is cut by water.

This area is climatically one of the best in Australia for cotton production. The soils are satisfactory and availability of irrigation water has been plentiful. While the price of cotton relative to grain remains high, cotton will continue to be the dominant irrigation crop of the floodplain.

Many types of forages are also well-suited to the floodplain, but are relatively unprofitable.

Erosion

The flood plain suffers little or no storm erosion and it is unusual for flood waters to cause erosion unless watercourses are cultivated.



Addendum to Land Management Manual Waggamba Shire

The need has arisen to emphasise the definition of land types in the manual and to clarify the procedure for naming Land Resource Areas and Soils.

Land classes

In this Land Management Manual land types have been described at two levels (see Part B, p. 3 of the manual):

- Land Resource Area (LRA)

-- a *map* unit covering larger areas and at a higher classification level than the Soils. An LRA can contain several Soils (see Part A, p. 33 of the manual).

- Soil

-- (more correctly a soil family) a *land* unit which occurs in simple or complex association with other Soils *within* a Land Resource Area (see Part A, p. 37 of the manual).

Soil naming

It has been a standing practice to use local names for soils in Australian land resource surveys.

LRAs are usually named after regional districts, parishes, rivers, creeks, or other physical features. Whereas Soils are generally named after local districts, properties, settlements, or local features.

For example:	Billa Billa LRA (parish)	--	Mt. Carmel Soil (property)
	Dumaresq LRA (river)	--	Oonavale Soil (property)
	Desert LRA (feature)	--	Yelarbon Soil (settlement)
	Jumpup LRA (feature)	--	Karbullah Soil (property)

Factors that influence the naming of soil types

☞ They have to be unique within and between surveys. For example, there should not be two soil types called 'Moonie'.

☞ A ready source of unique and relational names is necessary. Local district and property names that occur on a published map are a readily available source. This also provides a local link and aids familiarity with the name (more so than an arbitrary name or code).

☞ A soil that has been described and named in a previous survey is not renamed; it retains the old name.

☞ The reason for choosing a particular name varies according to the surveyor and the circumstances. The soil might take the name of the first site where it was encountered or it might come from the typical site for the best representation of that soil. It might take the name of a district or place where it occurs extensively and therefore typifies the place. Alternatively, the soil may be widespread in a particular area but take its name from an isolated, but nonetheless typical, site. For example:

i) The Weengallon Soil is widespread over several districts in the west, including Weengallon but the pit site, a good example of the soil type, is in Flinton district.

ii) The Wondoogle Soil is described from a pit on 'Glentown' where a good and accessible example of it occurs. However a 'Glentown Soil' name exists from a previous survey and could not be used. The Wondoogle Soil name also exists from where it was mapped in the previous survey and the name is therefore used to describe the soil in the Waggamba survey.

iii) The Bendidee Soil occurs frequently in Waggamba Shire but it has been described from a pit of a good example of the soil type which is outside the shire. This is a perfectly acceptable practice.

- 'Major' and 'associated' soils

On the back of the Land Resource Area map and in section 7.3 of Part A there is reference to 'major' and 'associated' soils.

Major soils are those that dominate within their related LRA **but** they are not the only soil types that may occur in that LRA. They are the soil types that *characterise* that LRA.

Associated soils are other soil types that may occur to varying degrees within an LRA depending on local changes in geology or land forming processes. These 'associated' soils of an LRA are the 'major' soils of *other* LRAs.

> For example: the Wondoogle Soil is a major soil of the Broomfield LRA but it can occur in small areas of the Serpentine LRA as an *associated* soil. In fact, the Wondoogle Soil occurs at Wondoogle only as an isolated associated soil of the Serpentine LRA; the Broomfield LRA is not mapped there.

Soil evaluation

For the Waggamba manual the soil information presented is not only a map and soil description but also an interpretation of the soil's productive capability and suitability for certain land uses. This is based on the best information available on soil attributes and crop requirements.

There is **no** implied connection between the local name (property, district, or whatever) and the performance of the soil type of that name; and none should be inferred. The soil type name, as outlined above, is only a tag to be hung on the soil description; it is not devised to associate with the soil performance.

If a soil type is named after a property or district, very little of that soil type may actually occur on that property or in that district, for the reasons outlined above. Therefore the soil name *cannot* reflect the productive value of that property or district.

Summary

- ☞ LRA and Soil names are a reference that must be unique and should not change.
- ☞ They provide a standardisation and continuity to soil surveys through time.
- ☞ Local names that appear on maps are used as a logical source for unique soil type names. There are many reasons why a soil type is given a particular name.
- ☞ There is no intention to link the local name and its soil type namesake to any expressed performance of that soil type. It is wrong to assume otherwise.

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For example:

Dumaresq LRA (river)	--	Oonavale Soil (property)
Desert LRA (feature)	--	Yelarbon Soil (settlement)
Jumpup LRA (feature)	--	Karbullah Soil (property)

Factors that influence the naming of soil types

☞ They have to be unique within and between surveys. For example, there should not be two soil types called 'Moonie'.

☞ A ready source of unique and relational names is necessary. Local district and property names that occur on a published map are a readily available source. This also provides a local link and aids familiarity with the name (more so than an arbitrary name or code).

☞ A soil that has been described and named in a previous survey is not renamed; it retains the old name.

☞ The reason for choosing a particular name varies according to the surveyor and the circumstances. The soil might take the name of the first site where it was encountered or it might come from the typical site for the best representation of that soil. It might take the name of a district or place where it occurs extensively and therefore typifies the place. Altenatively, the soil may be widespread in a particular area but take its name from an isolated, but nonetheless typical, site. For example:

i) The Weengallon Soil is widespread over several districts in the west, including Weengallon but the pit site, a good example of the soil type, is in Flinton district.

ii) The Wondoogle Soil is described from a pit on 'Glentown' where a good and accessible example of it occurs. However a 'Glentown Soil' name exists from a previous survey and could not be used. The Wondoogle Soil name also exists from where it was mapped in the previous survey and the name is therefore used to describe the soil in the Waggamba survey.

iii) The Bendidee Soil occurs frequently in Waggamba Shire but it has been described from a pit of a good example of the soil type which is outside the shire. This is a perfectly acceptable practice.

Your Reference:
Our Reference: LRB 42R 006
Contact: Mr R.N. Thwaites (Telephone: 07 877-9529)

June 1991

Dear Manual User,

We trust you have now familiarised yourself with the Waggamba Land Management Manual and are finding it useful and informative.

We have thought it necessary to supply you with an addendum to the manual, which you will find enclosed, to clarify the issue of naming the LRAs and Soils.

This manual is one of the first documents from the Department which has both:

- provided basic descriptive *and* interpreted soil information; and
- been widely distributed to landholders and other users

and therefore a fair amount of attention of the users has centred on using familiar local geographical names as LRA and Soil names strictly in the terms of the soil survey.

Some confusion has arisen in concerning the difference between an LRA and a Soil as well as getting used to using familiar names as Soil names. We hope this addendum will clear those things up for you if you have a problem with them.

We felt it best to leave these explanations out of the manual originally. However, we now realise it is an important enough issue to act on it now and provide some supporting information.

If you have other comments or issues you wish to raise about the manual please contact members of the local QDPI office or the Waggamba Conservation Committee. We wish you to get the most out of your manual.

The Editors