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Pasture under adverse conditions - Handling what you have

Grazing to manage natural grasslands

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Summary: Natural grasslands are a mixture of plant types – trees, perennial grasses and annuals, that are always fluctuating in their dominance but at very different rates. Without perennial grasses, the resource is ecologically unstable and pastoral production is unsustainable without a system of regular destocking. Mean annual rainfall and soil fertility, via soil nitrogen levels, predetermine the inherent productivity of a piece of country. Grazing and property management systems determine how close animal production gets to the long term potential.

In any rural enterprise, the management options taken need to at least maintain the soil resource – its chemical health and water holding capacity. All other components of sustainable resource use can be regenerated - but beware, the time required and the cost may be unrealistic and therefore quite uneconomical. We believe sustainable use of natural grasslands depends upon adequate management flexibility to ensure the perennial grasses enjoy a rest at critical times.

The basic resource

Natural grasslands around the world are dominated by perennial grasses and have stayed open either because wildfires burnt them severely with great regularity or trees could not survive extreme cold. Otherwise they were in a transition from either semi-desert or from woodlands and forests. Human activities slowed or hastened such transitions to varying degrees. Current native or natural grasslands are no longer pristine and reflect human management, over thousands of years in some areas. They will always require management to maintain enough perennial grass cover. If the perennial cover in western Queensland and New South Wales decreases too far we risk turning our grasslands into semi-desert because our rainfall is not reliable.

Grasslands mean different things to different people in New South Wales. In a 600 mm rainfall zone they are dense and almost sward-forming while those out west with a 350 mm rainfall are open, dominated by tussock species with annuals in between. In the south, temperate species dominate while near Queensland tropical grasses usually dominate. Hence, simple statewide recipes for managing them do not exist. Basic recipes for sustainable use do exist and will be discussed later.

People running grazing enterprises with relatively small, intermittent cash flows take risks and they manage as close to the borderline as their attitude to risk and their financial backers will allow. Therefore, if an unforeseen disaster strikes, they can be in big trouble – financially and environmentally. There are sometimes short-term ways of easing the pain but repeated excesses have a habit of catching up in the long term. So it is with natural grasslands. They can be resilient because of their mixed composition, provided they are not repeatedly abused and left without any strength to recover.

Soils and inertia

In the past, an "unproductive" native pasture was often turned into cropland or sown to 'improved' species to overcome perceived problems or to increase the rate of cash flow from poorer soils. In many cases this was akin to dipping into the soil capital reserves (nutrients and organic matter) and worked for a while until that 'capital resource' was consumed. Inputs of seed, fertiliser and diesel help to delay the decline but history seems to be telling us that we cannot continue this way in the absence of perennial grass pastures if we wish to have a sustainable resource (soil). Australian soils are very old and infertile compared to many others in the world that are derived from volcanic, glacial or more nutrient-rich origins (Coventry and Williams 1990). Thus they run out of fertility more rapidly and lose their friable structure more rapidly than many other soils.

Natural pastures are low cost pastures, but also lower production pastures because they have only part of the total nutrient pool available to them for growth at a particular time. They are also low energy expending pastures *ie.* no ploughing is needed, yet still have comparatively high stored energy levenergy expending pastures *ie.* no ploughing is needed, yet still have comparatively high stored energy levels (in roots and organic matter) and high inertia, *ie.* potential to resist change. This high ecological inertia is the sum of the reproductive and biological energy stored in seeds, growing plants, soil organic matter and micro-organisms. External forces trying to destroy or remove them, *eg.* fire, erosion, ploughing, overgrazing, herbicides etc. are resisted but by different components and with differing degrees of success. However, in total, they can largely maintain the status quo provided the assault is not sustained for too long nor on too many fronts.

Botanical composition is one of the easier features to change, followed by micro-organisms and seed loads, while soil organic matter is one of the most resistant. However, we can destroy much of the soil organic matter and, as a consequence soil structure, by continually mobilising it and preventing its renewal over many decades (Dalal and Mayer 1986). If soil is only marginally altered from its natural state, it is fairly easy to recolonise it with its native plants and micro-organisms, provided there are seeds or propagules left and provided continuing use of the resource is moderate. However, if soil physical or nutritional changes are too severe, then not all the native vegetation will return. As a consequence, many micro-organisms and animals that use such plants for food or shelter and play a big part in nutrient cycling may also fail to recolonise.

Botanical composition

Natural pastures have a major strength – the plants are well adapted to persisting on their soil/land unit under normal grazing and climatic conditions without any need for ploughing or fertilisers. There are some species which can adapt to quite major soil changes provided the climate or defoliation conditions do not change much, *eg.* kangaroo grass, windmill grasses, many wattles and poplar box. The reverse also applies, – changes in defoliation regimes, soil water availability or fire incidence will eliminate some native species, *eg.* kangaroo grass and oldman saltbush by regular grazing, Qld bluegrass and *Psoralea* spp. by summer drought and mulga or saltbush by fires.

Plant contrasts

Perennial grass types

Managing perennial grasses is greatly helped by appreciating the two major physiological types, temperate (C_3) and tropical (C_4). They differ primarily in their ability to grow at high temperatures under intense light and moisture stress (Hattersley 1983). C_4 grasses *eg. Panicums*, bluegrasses and buffel grass thrive in strong light and at high temperatures but are unable to withstand prolonged cold, damp conditions. In contrast, C_3 grasses grow well under dull light and cool temperatures and are not killed by prolonged wet, freezing conditions *eg.* fine-leaf tussock, wallaby grasses and *Phalaris*. Table 1 lists common import-ant grasses in natural grasslands of western NSW. Most non-grasses and legumes are C_3 plants, except for a few saltbushes and some succulents like prickly pear. In many cases, related species of a genus have the same physiology type, *eg.* most lovegrasses (*Eragrostis* spp.) are C_4 plants and most *Stipa* spp. are C_3. Note how few perennial C_3 grasses there are compared with C_4 ones. Sedges and rushes are a mix of physiological types.

Contrasting nutrient levels

Grasses, and probably sedges, have an inherently different nutrient composition to non-grasses. They have lower protein contents when mature and lower mineral contents, particularly of calcium, potassium

Table 1. Important perennial grasses of western NSW classified by their dominant physiological metabolism.

C4 (Tropical)	C3 (Temperate)
Black speargrass (*Heteropogon contortus*)	Corkscrew grasses (*Stipa* spp.)
Bottle washer grasses (*Enneapogon* spp.)	Fineleaf tussock (*Poa sieberiana*)
Buffel grass (*Cenchrus ciliaris*)	Greybeard grass (*Amphipogon caricinus*)
Curly windmill grass (*Enteropogon acicularis*)	Mulga mitchell (*Thyridolepis mitchelliana*)
Fairy grass (*Sporobolus caroli*)	Mulga oats (*Monachather paradoxus*)
Golden beard grass (*Chrysopogon fallax*)	Rough speargrass (*Stipa scabra*)
Green couch (*Cynodon dactylon*)	Slender bamboo grass (*Stipa verticillata*)
Kangaroo grass (*Themeda triandra*)	Wallaby grasses (*Danthonia* spp.)
Lovegrasses (*Eragrostis* spp.)	Weeping grass (*Microlaena stipoides*)
Mitchell grasses (*Astrebla* spp.)	
Native millet (*Panicum decompositum*)	
Neverfail (*Eragrostis setifolia*)	
Pitted bluegrass (*Bothriochloa decipiens*)	
Queensland bluegrass (*Dichanthium sericeum*)	
Redleg grass (*Bothriochloa macra*)	
Silky browntop (*Eulalia aurea*)	
Spinifex (*Triodia* spp.)	
Windmill grass (*Chloris truncata*)	
Wiregrasses (*Aristida* spp.)	

major differences which require differential management. A few grasses, especially buffel grass, have high soluble oxalate levels which can lead to poisoning and big head in horses. High oxalate levels also exist in many succulents such as pigweed, soda bush (*Neobassia proceriflora*) and some copper burrs (*Sclerolaena* spp.) (Silcock and Smith 1983). Some grasses, *eg. Panicum* species can cause photosensitisation in susceptible animals, and so can certain non-grasses (Henry *et al.* 1995) but they are a tiny minority.

Pasture management

Main plant types

For pasture management guidelines, plants can be divided into the following four groups:

- Trees and woody plants;
- Perennial grasses;
- Perennial non-grasses; and,
- Annuals.

Trees and woody plants provide shade and shelter, often have an important role in landscape stability, have a restricted dietary role but are a big potential expense in property management. Their role in drought mitigation has been over-emphasised to the detriment of pasture stability and composition. In Queensland we now realise that the old logic that "good old mulga always saves ya" can lead to degradation of the country in the long-term if overused as drought fodder. You have the same problem in the Cobar-Byrock area. Browse trees and shrubs are very valuable short-term feed supplements but should not become the main source of feed for long periods. The country is being overstocked when this happens. Nutritive value of browse leaf is often much lower than a simple chemical analysis would indicate when browse is the main diet because of high tannin and lignin contents.

Perennial grasses are the cornerstone to landscape and production stability in permanent pastures. They provide durable cover, standing dry roughage and a fair to good quality diet during the growing season. Dietary quality depends upon the species. Grasses fill bellies but some have sharp seeds and very stalky growth that is unwanted. They fuel fires.

Perennial non-grasses are a mixed group with saltbushes, copper burrs, sedges, flannel weeds and some daisies being the most obvious. Many small legumes are also in this group, *eg.* grey rattlepod and bullamon lucerne. They vary in quality and palatability but, if eaten, are a valuable quality diet where sufficient grass is available, especially in the dry season. They are often green when grasses have hayed-off or been frosted.

Annuals, both grasses and non-grasses, are a mixed value group. Many have sharp, undesirable seeds or are unpalatable (flaxweed *Pimelea* spp.) or aggressive (rolypoly *Salsola kali*, caltrop *Tribulus terrestris*). Many are exotic weeds *eg.* wild mustards *Brassica* spp., Paterson's curse *Echium plantagineum*. Others are extremely valuable sources of forage, colonise bare ground readily and resist heavy grazing. Their big weakness is an unpredict-able presence, due to unreliable germinating rains and complex seed dormancy mechanisms. Many have a mix of good and bad points, *eg.* cutleaf medic *Medicago laciniata*, pigweed *Portulaca* spp. and bogan flea (*Calotis hispidula*).

Native Pasture Management

Decision making

The four main plant groups can always be used as a basis for general pasture management decisions. However much still depends on the 5-10 key plant species in each pasture because some plants in every group behave differently on some issues. We can never have too much information available about native pasture plants, but practical management will often see decisions made on the basis of perceived priorities not a complete integrat-ion of all relevant factors. Hence, different operators may desire a different pasture composition to suit their markets and operation.

Basing decisions on perceived or rationally derived animal priorities, *eg.* to feed supplements, is a common way of operating and is a very sensible way to operate if the pastures are in good condition. A healthy pasture has resilience and can withstand short-term damage provided an appropriate rehabilitation process is used thereafter. For example, we often advocate deliberate, short-term hard grazing for perennial pastures to remove weeds or excess rank growth, especially in new sown pastures. This needs to be done so that the major damage is to the unwanted pioneering plants.

Animal Production

Potential animal production fluctuates with seasonal conditions and very few graziers can match animal numbers to pasture growth for very long. Under good conditions the pasture grows much faster than animals can eat it, even at 2-3 times the normal stocking rate. During that growth phase, animal growth rates can be very good for several months, – greater than 1 kg/day for young cattle and >150 gm/day for 2-4 tooth sheep. Stocking rate has minimal effect on animal performance at this time. However, once the pasture gets stemmy and dry, animals cannot select as freely and the picture changes and grazing pressure becomes crucial (Figure 1).

On dry or stemmy winter pastures, high grazing

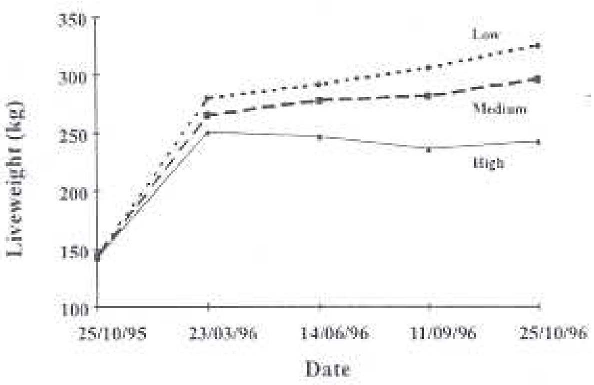

Figure 1. Cattle liveweight changes at three different grazing pressures over one year on native *Aristida/Bothriochloa* pastures in inland Queensland. Summer feed was green and plentiful, the winter was cold and dry and the spring was fair. Meaned stocking rates were a weaner steer to 1.6, 2.5 and 5 ha of lightly timbered country.

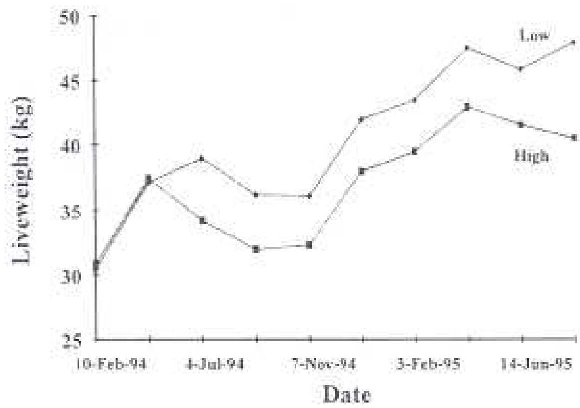

Figure 2. Growth of two-tooth wether sheep at two different stocking rates throughout 18 months on buffel grass/wiregrass pastures at Roma. Lower stocking rate was half that of the other. Summer feed was excellent each year but the winters were extremely dry and cold with no winter herbage.

pressures produce rapid falls in daily growth rate (Figure 2). Falls can still occur at moderate/sustainable pressure but the nett effect is small compared to those at higher grazing pressure. In Central Queensland, young steers have continued to gain weight throughout our dry winter and spring if they had access to plenty of hayed-off pasture. Stem is far less nutritious than leaf (Table 2) but not unproductive if there is high quality herbage to supplement the diet. A small amount of Mayne's pest (*Verbena tenuisecta*) or galvanised burr (*Sclerolaena birchii*) will compensate significantly for a bulk of stemmy bluegrass or buffel but not of wiregrass if the latter is too tough to chew. Five percent fuzzweed (*Vittadinia cuneata*) leaf in the diet increases Qld bluegrass energy value by 9%, the effect being greater the more stemmy the feed (Table 3).

Where the main product is wool, net growth continues on dry pasture and, in rangeland Australia, severe breaks in the staple are not common because the diet does not alter too rapidly. However, overall staple strength will tend to fall as diet quality

Table 2. Nutritive value of different plants in mid-winter at Roma during a very cold, dry season. (Silcock and Hall 1996 & unpublished data)

Plant species	Part	ADF (%)	Protein (%)	Phosphorus (%)	IVDMD (%)	ME (MJ/kg)	Leaf (%)	Green (%)
Feathertop wiregrass	Leaf	44	2.9	0.03	32	5.1	40	13
	Stem	56	2.0	0.01	21	4.2		70
Kangaroo grass	Leaf	44	2.5	0.02	33	4.9	18	3
	Stem	57	1.5	0.01	18	4.0		80
Queensland bluegrass	Leaf	45	3.4	0.04	37	5.1	49	3
	Stem	58	1.5	0.01	27	4.0		35
Buffel grass	Leaf	41	2.6	0.03	42	4.6	38	0
	Stem	55	1.7	0.03	25	4.5		75
Corkscrew grass	Leaf	42	4.5	0.04	30	6.2	42	35
	Stem	57	2.8	0.03	20	4.5		1
Mayne's pest	Leaf	15	17.5	0.14	75	11.8	25	85
	Stem	34	8.6	0.10	56	8.4		95
Fuzzweed	Leaf	13	12.0	0.28	66	11.0	30	95
	Stem	36	5.2	0.19	55	7.4		90
Galvanised burr	Leaf	20	16.9	0.08	67	12.2	20	80
	Stem	44	7.7	0.06	32	6.8		70

Notes: ADF = acid detergent fibre; IVDMD = *in vitro* dry matter digestibility; ME = metabolisable energy.

1. For lower quality forage, *in vitro* digestibility values below 30% tend to underestimate the true *in vivo* feed potential.
2. No allowance is made for the effect of tannins on protein availability.
3. ME predicted from the ADF, Protein and Organic Matter content gives a better measure of feeding potential, particularly for low quality forage, than does *in vitro* digestibility.

Table 3. Effect of a small proportion of high quality herbage (Fuzzweed) on the feed value of dry, mid-winter Queensland bluegrass. Data based on Minson and McDonald (1987) and Table 2.

% forb leaf	Metabolisable Energy (MJ/kg) from the diet % grass intake as dead leaf rather than dead stem				
0	3.9	4.0	4.5	**5.0**	**5.1**
1	4.0	4.1	4.6	**5.1**	**5.2**
2	4.1	4.2	**4.7**	**5.1**	**5.2**
5	4.3	4.4	**4.9**	**5.3**	**5.5**
10	4.6	**4.8**	**5.2**	**5.7**	**5.8**
15	**5.0**	**5.1**	**5.6**	*6.1*	*6.2*
20	**5.4**	**5.5**	**5.9**	*6.4*	*6.5*

Values in bold show the diet could maintain weight on a 250 kg steer. Only those with an ME above 6.0 would maintain a 350 kg steer in a dry winter.

drops (hungry fines) and producers need to be wary of too sudden a change in diet quality on very grassy, frosted pastures. At Roma, very grassy buffel pastures produced wool of acceptable strength but wiregrass-dominated ones had a greater proportion of animals growing weak fibres (Silcock and Hall 1996).

Realistically there are periods when animal growth will not be good on native pastures. That is when management has to decide whether to supplement, to move to improved pastures or a feedlot or to reduce stock numbers further. In very cold climates, the threat of blizzards forces pastoralists to take their animals off native pastures early each winter without the option of hanging on. In much of Australia, pastoralists can hang on much longer with some hope of their stock surviving if rain was to fall soon. This deep optimism is the source of many of our rangeland problems. Without drinking water, the same forced destocking occurs in semi-deserts but we have sunk deep bores to avoid that restriction. We operate in a very unreliable rainfall region with a fairly low expected total so cannot be overly optimistic of production potential per hectare.

Maintaining the Resource

Pastures and soil both need to have periods of refurbishment and replenishment just as machines and animals do. Native pastures need to have some plant material left to satisfy needs other than those of the domestic animals, *eg.* soil cover. Plants also have a finite, individual lifespan characteristic of the species. Ground cover is well documented for its role in minimising runoff and raindrop impact. Less well known is its role in providing habitat for small insects and fungi as they burrow beneath and digest some of it. Macropores in the soil (>0.75 mm diameter) provide soil with the ability to move large amounts of storm water very rapidly to significant depth. These macropores are produced almost exclusively by termites and burrowing insects in inland Australia (Eldridge and Koen 1993).

The fungi which decompose dead plant material are also vital and can only operate effectively in humid, low light intensity conditions. Thus open pastures are not conducive to their activity. Earthworms, though valuable, are rare in semi-arid environments and their recycling role seems to be taken over by termites and ants. Just how many positives and negatives are associated with the latters' colonies is unclear but their effect is very obvious in places, *eg.* hard mounds (termites) or numerous nests (funnel ants). Giant cockroaches plough up mulga scrub soils at times which helps keep them friable but they seem to need tree leaf for their nests. We believe that the preference of buffel grass for growing under certain trees is as much associated with micro-organism activity as it is with raised soil pH, phosphate and potash. The role of trees and shrubs in providing habitat for wildlife that is beneficial to the balance of pests and diseases, *eg.* birds and large insects, is poorly documented in Australia but the benefit of dung beetles in subduing flies is obvious.

Strategic rests

To maintain a healthy pasture ecosystem there needs to be a certain proportion of ungrazed forage returned to the soil surface. There must also be strategic rests of the pasture to allow the more palatable plants to revitalise and seedlings to establish. In a good mixed pasture, resting of individual plants and species tends to occur automatically in rangelands as animals select for the most palatable or nutritious individuals each day. Different growth rhythms and degrees of flowering ensure that most species take turns in being the most desired plant and give the others a chance to set some seed or regenerate shoots and roots. Plants that do not get such a rest (usually the continually leafy ones) are the ones needing special manage-ment. Conversely, plants that are almost always ungrazed may need to be selectively defoliated by other means to prevent them from overrunning the pasture. The rest or heavy use period need not be very long, 4-6 weeks, provided it occurs at the crucial time. For desirable existing plants in western NSW, that is after rain at a time when they are likely to flower. For annual species regenerating from seed, flowering is also their most beneficial time because after germination there is plenty of other green feed for livestock to eat in a healthy pasture.

In cold climates and in deserts, the most beneficial rest for pastures comes just after the start of the growing season. This is why rapid restocking after a drought is discouraged and why mountain grazing lands are kept closed until well after the snow has gone. Preferred plants must be allowed to regrow enough leaf so that they are able to restore used-up crown buds and to regenerate new, deep roots that will survive for at least another year or two.

Pasture consumption foregone for a short, critical time repays benefits for many years later, most commonly in the form of more stable pasture productivity from year to year and a more friable soil surface which captures a greater proportion of incident storm rain. Animals will also experience smaller setbacks to their growth in dry times if they are not forced to eat a high proportion of less nutritious stem material.

Another important point is that seeds of many dominant, perennial grasses do not survive very long lying out in the paddock. Woollybutt (*E. eriopoda*) and neverfail (*E. setifolia*) are exceptions with highly dormant fresh seeds. For Queensland bluegrass, buffel, Mitchell grass and wiregrasses 2-3 years is the maximum in semi-arid climates. Hence when good rain occurs, enough viable seed needs to be there to respond because only a very small percentage will survive to flower (probably <1% on average and <7% after good rains). The plants you commonly see after droughts are the ones with long-lived seeds, *eg.* native legumes, fairy grass, some sedges, flannel weeds, pigweeds and wild flowers such as bluebells and daisies.

Management options

In northern Australia, we believe that consumption by stock of 30% of the weight of forage grown is a desirable, long-term sustainable grazing pressure. This means 70 - 80% of the height of most tufted grasses. In practice, this figure includes this summer's growth and any excess carried through from the previous year. After a very good season this consumption level could be increased to 50% without detriment. The remaining material is accounted for by wild mammals (including kangaroos), by insects and termites, by trampling and by natural weathering and decay. Where there are distinct wet and dry seasons, a single, annual assessment gives producers the opportunity to plan for any significant change in stocking rates. The change need not be implemented immediately but if a reduction is delayed there must be a bigger change later to compensate. This rule of thumb will always provide adequate feed to get stock through 12 months if there is a severe drought next summer or a very late break to the wet season.

In an aseasonal rainfall environment like western NSW, picking a satisfactory time to do the assessment is not as easy. However, at the end of any good grass-growing season would be appropriate (max-imum twice a year). You are very likely to get some more rain within 12 months but much of the soil nitrogen will be tied up in the plant bulk, so growth of extra bulk will be limited until much of the current feed is consumed or has died before there is another big growth burst. Feed quality may change markedly as pastures green up after storms and animal growth/health will benefit greatly. But the general quantity of dry matter consumed will be governed mainly by grazing pressure (numbers x metabolic size).

Metabolic size

Metabolic size is very important and often under-rated when setting stocking rates for a full year ahead. For example, a 250 kg steer consumes about 5 kg/day of dry matter when growing at 0.2 kg/day and only 25% more when growing at 1 kg/day (5 times faster) (Minson and McDonald 1987). The same steer losing 0.1 kg/day still consumes 4.5 kg/day (95% of the slowly growing animal). By comparison a 400 kg bullock eats about 7.0 and 8.4 kg/day respectively to put on weight at the same two rates mentioned. A lactating cow weighing 350 kg and maintaining weight with a 6 wk old calf at foot consumes more than the fast-growing bullock. Likewise, a lactating merino ewe with a single lamb demands 45% more feed during that lactation than a dry adult sheep (Henry *et al.* 1995).

Adjusting numbers

Buying and selling stock to adjust grazing pressure needs to be minimised unless you are running a bullock or wether depot. There are many pitfalls these days when bringing in animals from other districts, not the least being potential chemical residues. If you have a good feed supply, it would be better to move animals around on the property to utilise feed sustainably and give selected paddocks a rest than buying many extra stock or taking on agistment. It is easier to lighten off adequately in a particular paddock than to strategically crash graze all or part of a paddock. Short duration heavy grazing for a particular purpose really requires the job to be done in 1-2 months and 10-20 times the number of animals per hectare that would normally be run in a set stocked system. Any longer and palatable perennial plants can be seriously weak-ened. The aim is usually to remove unwanted seedlings or old rank growth of unpalatable species like wiregrasses. Such grazing carries a short-term animal performance penalty but may be the most economical option because no outlays for chemicals or machinery are needed. Healthy animals should show compensatory weight gains when put back onto good feed at normal grazing pressures.

Plans

Plan pasture management strategies at least a few years ahead. Identify the paddocks or areas that need attention, shortlist the options you could use for each activity and the pre-requisite steps and then assign priorities (Booth 1985). This doesn't mean things will always get done in that order but you have identified the aims and should be able to activate a predetermined response at the appropriate season. When required, if you have a really good summer, spell the weakest pasture or prepare for a burn in areas with bad young regrowth. If there is some spare cash, build the lane or speartrap yards or put in a subdividing fence that you have planned to make mustering easier. The scenarios are endless but without a plan and a list of important management objectives, opportunities will be missed. There is a lot of publicity nowadays about targeting markets but without a robust forage resource behind you, targets will be difficult to achieve consistently. Integrate native pasture usage with forage and grain crops when this is an option but don't use either indiscriminately. The recent Helix pesticide scare from feeding crop residues to stock should be soberly remembered forever.

Burning

Fire has a natural and vital role in grasslands but we often ignore that and use machinery or chemicals as an easy substitute. Our impression and experience is that problems associated with using fire are largely overstated or attitudinal. Some people use controlled fires regularly and are comfortable with their situation. Their rule of thumb is 'the nearer conditions are to fireban days, the better the result will be'. The fires that burn better than expected are the long-term successes usually. Those who never use fire are mostly very wary of it for the opposite reason, lack of confidence.

If fires are not strategically used on grasslands, then strategic crash grazing, chemicals or machinery must be regularly used instead. Otherwise the trees will take over for sure, eg. the Piliga scrub and most mulga country. On some country, machinery is not an option and chemicals have to be used. Early treatment of isolated regrowth outbreaks is the best way to go with chemical methods - plants are smaller, more accessible and have not yet put much seed into the soil.

Plant Identification

Graziers' ability to identify their main native plants has improved in recent years, aided by some guides with coloured photos (Mitchell 1996). In Queensland, a series of native pasture management guides has been published recently to help, each with photos of important species for that pasture type (Partridge 1992, 1996a,b). On most properties, the ability to identify and know a few key things about 50-60 plants is the goal we would set. There are many more native plants on a property but most can be identified and managed adequately using the four functional groups listed earlier. "Plants of Western NSW" (Cunningham *et al.* 1992) is an excellent book for this region but needs a simple guide to take non-technical people to the right part of the book, ie. via simple keys or photoguides to a family or small subset of plants, eg. saltbushes, paper daisies *etc.* Henry *et al.* (1995) use a key which does just that for their 240 plants.

The more difficult thing is to identify key plants in their seedling stages when they are most vulnerable. If a grazier can pick a flush of hopbush or turkeybush seedlings early, a short crash grazing with sheep during a dry spell may solve the emerging problem. Conversely, if summer rains bring up a crop of Mitchell grass seedlings, a few months rest before winter should almost ensure that many survive. It is most important with grasses to let secondary roots take hold so that the crown can resist grazing. Such roots can only grow when the surface soil is moist for a few days and after the seedling has started to tiller or stool out.

Other observations and suggestions

- Established wallaby grasses can withstand short-term heavy grazing very well and are very nutritious plants. Follow the Wiregrass Action Group recipes from the western slopes (Wiregrass Action Group 1986).
- If floods kill out Mitchell grass stands, spell the area as much as possible after the next summer rains so that seedlings can re-establish the pasture. Otherwise weeds take over.
- Perennial grasses do not normally disappear overnight due to heavy grazing alone. The most susceptible species are the short-lived perennials (Grice and Barchia 1992).
- Be prepared to control kangaroos diligently in paddocks that you are trying to rest. Wallabies are much harder to deal with.
- Spells need only be for a few weeks around early flowering to achieve excellent seed production for most species. Once seedhead stalks develop, animals tend to avoid them unless they are very hungry.
- Perennial saltbushes are slow to establish and only rarely successfully recruit large numbers of plants. Therefore, if a saltbush is important to your operation, don't run it down too far and let it seed regularly so a few seedlings occasionally re-establish.
- Having both sheep and cattle available for grazing is a great help. Cattle eat wiregrasses much better while sheep eat small shrubs better. Whether they graze together or in separate mobs does not matter much as far as pastures are concerned.

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