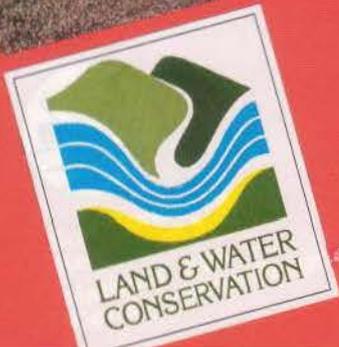
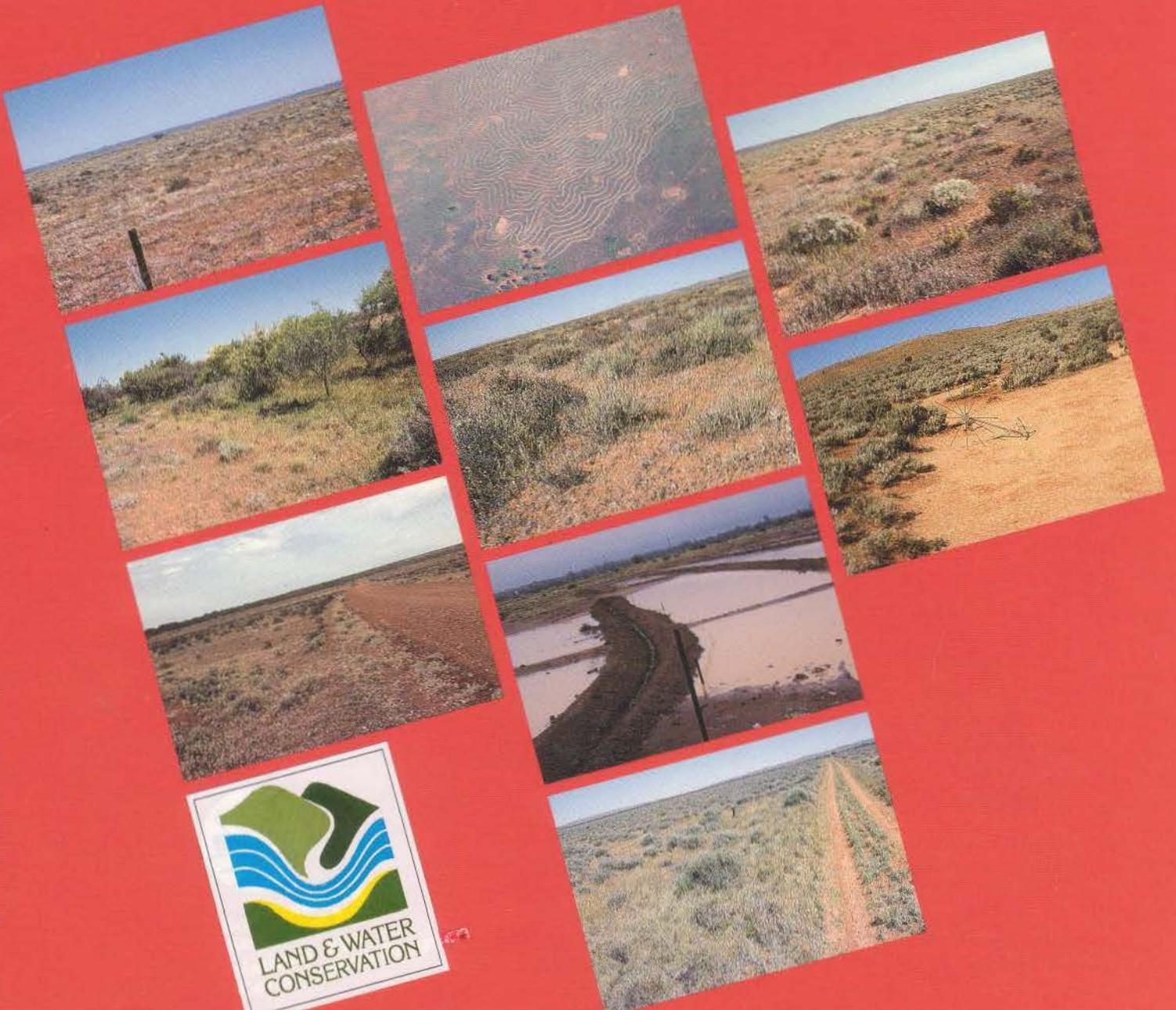


A **Graziers'** GUIDE TO THE
Saltbush~Bluebush
DOWNNS
Country

OF WESTERN NEW SOUTH WALES



A GRAZIERS' GUIDE TO THE SALTBUSH~BLUEBUSH DOWNS COUNTRY OF WESTERN NEW SOUTH WALES

The saltbush and bluebush pastures of the downs country are valued by the pastoral industry for the production of high quality wool. However, because of the replacement of valuable perennial plants by less desirable species and the impact of soil erosion, many areas of the downs country are not producing to their optimum potential.

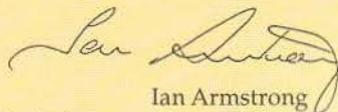
This has several implications for you as land managers. Firstly, it reduces your financial return, secondly, it reduces your management options and, thirdly, it means that future owners of your land will have a much harder time making a living from it.

The aim of this booklet is to help you better understand and manage your downs country.

The western rangelands are vital both to the economy and to the environment of New South Wales. Their utilisation in a sustainable and responsible manner requires a full understanding of the management needs of these diverse and sometimes easily damaged semi-arid lands.

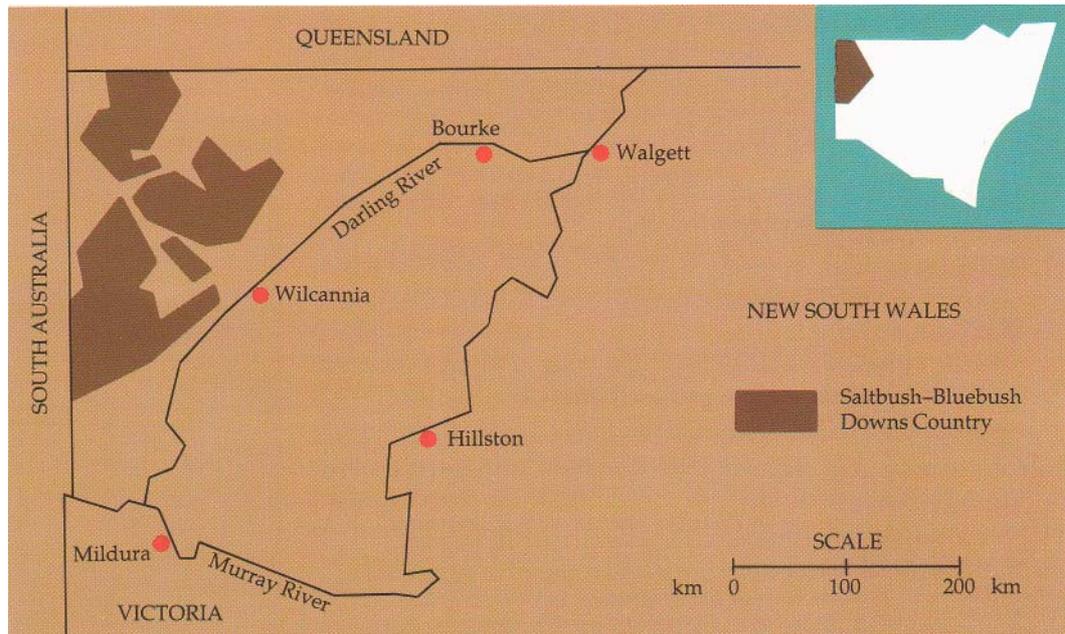
These guidelines have been prepared with financial support from the National Soil Conservation Program as part of a series covering the western rangelands. The management practices covered provide for the optimum use of species, the regeneration of degraded areas and recognition and preservation of habitat values.

The NSW Government is committed to achieving the balance between resource utilisation and sustainable production. I most strongly commend these guidelines and the others in the series to all landusers.



Ian Armstrong
Minister for Agriculture and Rural Affairs

The extent of the downs country in New South Wales.

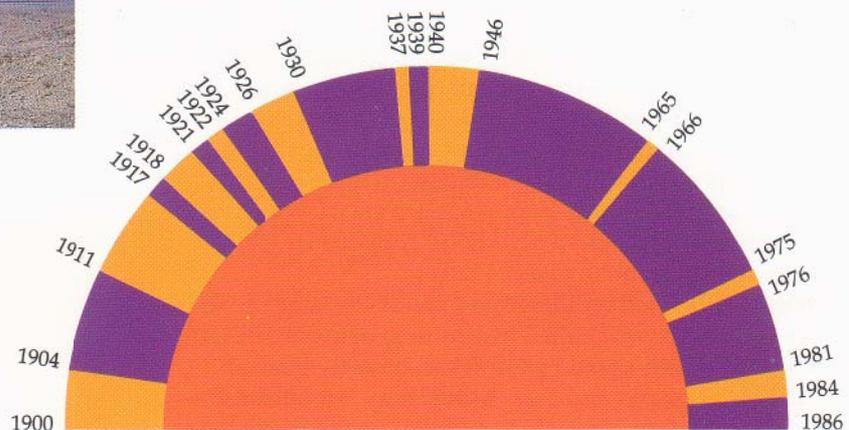
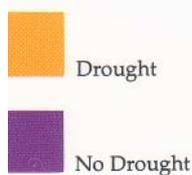
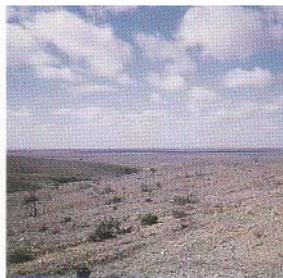


The downs country of far western New South Wales typically includes level to undulating terrain supporting mainly saltbushes (*Atriplex spp.*) and bluebushes (*Maireana spp.*) and smaller areas of mitchell grass (*Astrelba spp.*), mulga (*Acacia aneura*) and belah (*Casuarina cristata*), with river red gum (*Eucalyptus camaldulensis*) along the creeks. Similar areas of country occur extensively throughout South Australia, and in parts of Western Australia. This guide is concerned only with the downs country in New South Wales.

Most of the area can be described as arid, with a low and erratic rainfall. Rainfall patterns range from a fairly even distribution throughout the year around Broken Hill, becoming more summer dominant in the north of the State. Due to the very high temperatures experienced in summer, evaporation rates are also very high. Consequently, rain falling during the summer months is much less effective than a similar amount falling in winter.

Dry spells and droughts are common. The diagram below shows the major droughts (as opposed to dry periods) that have occurred in far western New South Wales since 1900.

The downs country includes both flat and undulating terrain carrying mainly saltbush and bluebush pastures.



The droughts of western New South Wales since 1900.

Most of the downs country supports a mixture of perennial bushes and grasses supplemented by annual herbs and grasses. The system balance is rainfall dependent. Annual species produce a flush of green feed after rains and die off when conditions turn dry. Perennial species usually live much longer because they can use moisture held deeper in the soil and thus survive dry periods.

MANAGING YOUR DOWNS COUNTRY

Achieving high levels of stock production as well as maintaining the rangeland in good condition is a challenge for the Brazier in downs country. Some of the factors limiting production include:

- lack of regular seasonal rainfall and very high evaporation rates during the summer months
- very high salt content of the saltbushes and bluebushes which makes a good quality water supply essential for stock
- lack of shade and shelter for stock
- competition from native and feral animals existing and continuing soil erosion
- deterioration of pastures from domination by perennials to reliance on annuals.

Considerable skill is required to operate within these constraints while maintaining short- and long-term productive capacity.

Important Plants of the Downs Country

The presence of some plant species has a particular significance for the rangeland manager. Some plants have a high forage value, others are noted for protecting the soil from erosion, some behave as weeds and others can indicate the pasture condition.

Plants can be valuable as **forage** because they are nutritious, digestible and/or palatable. Mitchell grass, windmill grass (*Chloris truncata*) and queensland bluegrass (*Dichanthium sericeum*) are all palatable and nutritious to stock in the earlier growth stages. The perennial saltbushes and bluebushes are all fairly nutritious, but their palatability is low and they are usually only grazed to any extent when other more palatable species have disappeared from the pasture.

The plants of greatest value for **soil protection** are the perennial species which offer year-round protection. Perennial grasses and herbaceous species such as mitchell grass and corrugated silo (*Silo corrugata*) help prevent erosion because they slow the rate of water flow at ground level and bind the soil with their roots. Perennial bushes such as the saltbushes and bluebushes, if present at an adequate density (that is, no more than 2 to 3 m between bushes), effectively reduce wind velocity at ground level and thus help to prevent soil movement.

Plants which are **capable of colonising** bare or eroded areas play an important role in the reclamation of these areas. These species stabilise the soil and/or make conditions more acceptable for establishment by other species. Colonising species include eastern flat-top saltbush (*Atriplex lindleyi*), pop saltbush (*A. spongiosa*), soft-horns (*Malacocera tricornis*), water weed (*Osteocarpum acropterum*), woolly copperburr (*Sclerolaena lanicuspus*) and buck bush (*Salsola kali*).

Species which tell us something about the state of our pastures are collectively called **indicator species**. For example, a paddock full of long-spined or streaked poverty bushes (*Sclerolaena longicuspus* and *S. tricuspus*) may tell us that the paddock has been consistently heavily grazed. On the other hand a paddock of fairly dense and vigorous bladder saltbush (*Atriplex vesicaria*) would indicate appropriate stocking rates.

death) in a short space of time, whilst still producing a large quantity of seed for the next generation. Annuals are generally the most palatable source of feed for stock, particularly in the earlier stages of plant growth. After seed set, haying off and a lowering of feed value occurs. Annuals are only present during droughts as litter, stubble or seed. The downs country produces annuals which can respond to either winter or summer rains. Major winter growing annuals include blue crowfoot (*Erodium cicutarium*), arabian grass (*Schismus barbatus*), new zealand spinach (*Tetragonia tetragonioides*), common white sunray (*Helipterum floribundum*), eastern flat-top saltbush and pop saltbush. An important summer growing annual is button grass (*Dactyloctenium radulans*).

Perennial plants live longer than two years. Unlike annuals, they do not rely solely on seed for regeneration, but can reshoot from growing points located in the butt (of grasses) or on the stems (of bushes and forbs). Perennials are slower growing than annuals and the seeds rarely germinate in large numbers. Such an event is dependent upon the right environmental conditions. However, the chance of regeneration is often increased by the ability of some perennial plants to seed twice in a year in response to favourable conditions. Perennials can withstand dry periods due to their deep root systems which improve the plant's ability to maintain a water supply to growing points. Two of the most common ways perennials survive drought is to reduce moisture loss from the plant by allowing leaves to die or by shedding leaves and remaining in a dormant state until the next rain.

Some plants behave as perennials during a run of good seasons and annuals when conditions are less favourable. These are known as **facultative perennials**. They generally produce large amounts of seed which increase their chance of survival after a dry period. Some facultative perennials are windmill grass, speargrasses (*Stipa spp.*), common bottlewashers (*Enneapogon avenaceus*) and queensland bluegrass.

There is a wide variety of plant species, both perennial and annual, present in the pasture of the downs country. This has two major advantages. In terms of production, stock can be provided with feed at all times of the year except in prolonged drought. In terms of stability and erosion prevention, the soil is protected by some form of vegetation cover at all times of the year.

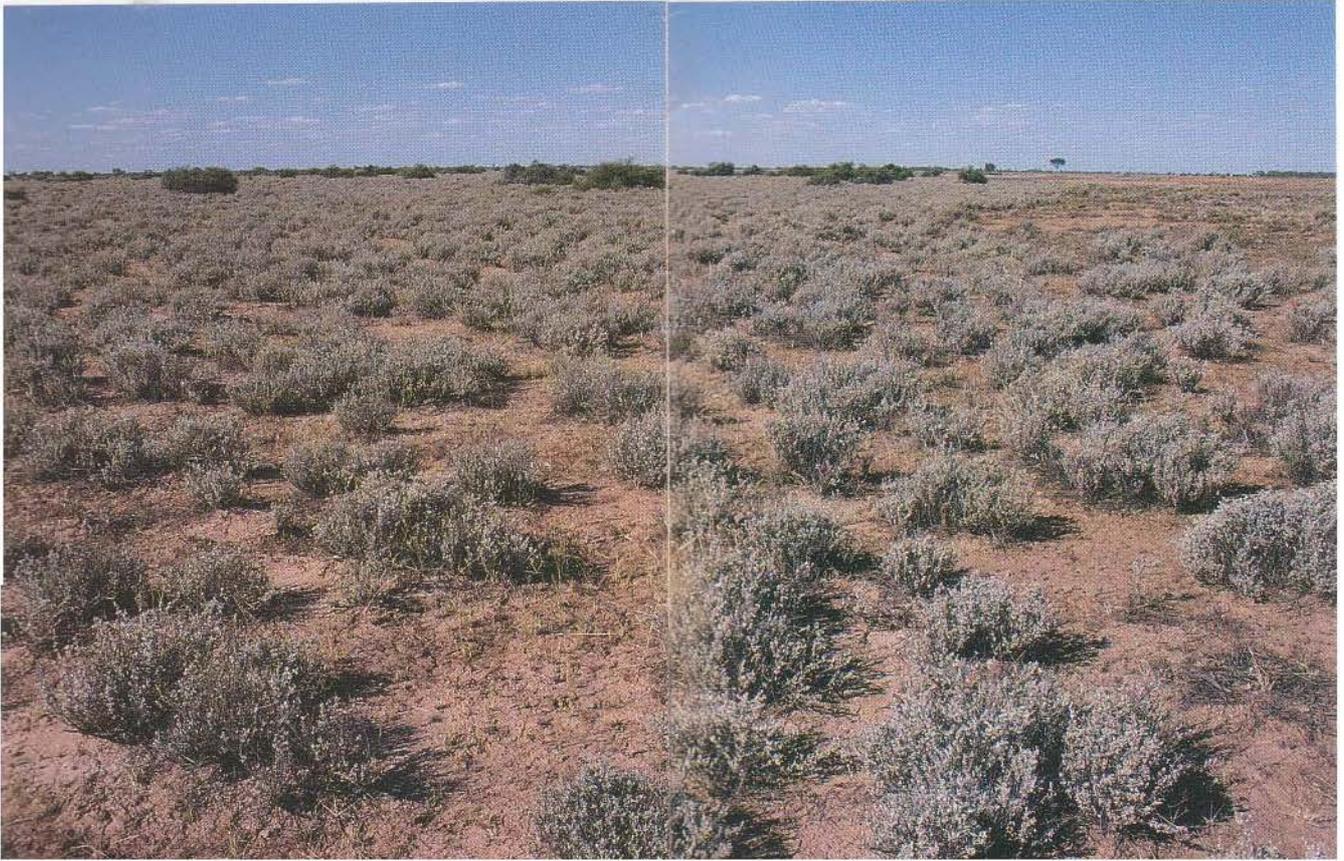
As a rangeland manager you should aim to maintain the vegetation and soil in a stable and productive state. This can only be done if you maintain perennial plants in your pasture.

Perennials are most important because they:

- provide a balanced diet and help prevent scouring in periods of flush growth
- enable stock to be carried in a dry period when annual plants have died
- compete successfully with undesirable plants such as the poverty bushes protect the soil and dry herbage from the effects of wind and water
- protect other establishing plants from the elements.

To ensure long-term stability the productive component of the pasture, the annual grasses and herbs that appear after rain, can be fully utilised, whereas the perennials should only be used to a level at which their presence in the pasture can be maintained.

Following events such as drought or fire it is necessary to allow perennials to re-establish.



The downs country in good condition.
Photo: Owen Graham



How do you maintain a balance of annuals and perennials?

Manipulation of grazing pressure is the principal management tool graziers have at their disposal.

It is difficult to change the abundance and distribution of short-lived annuals because they have the ability to seed and regenerate under most stocking rates. A stocking rate high enough to permanently remove annual species would almost certainly result in the destruction of most perennial species first. By setting a stocking rate which ensures that perennials such as saltbush, bluebush and mitchell grass are maintained, you also ensure the survival of the annuals in the pasture.

Stock find many of the annual grasses and herbs more palatable than perennials such as bladder saltbush (*Atriplex vesicaria*), low bluebush (*Maireana astrotricha*) and pearl bluebush (*M. sedifolia*), and will eat them in preference. Under moderate grazing rates this works as a natural management system-the bushes are spelled in periods of good rainfall when other more palatable feed is present, and then once this other feed has disappeared, the bushes are grazed until rain renews the cycle. Under very heavy grazing this cycle cannot continue because the saltbushes and bluebushes are unable to recover or set seed in time to cope with subsequent dry periods. In addition, erosion may reduce the productive potential of the rangeland by lowering the soil's waterholding capacity and nutrient status and by changing soil surface condition which decreases the ability of seedlings to establish.

Conservative stocking

General experience in arid areas has shown that lightly stocked properties are more profitable per head than more heavily stocked ones. On lightly stocked properties, stock can be maintained for longer in a dry period when prices are low, and as a result, stock do not have to be bought back in when prices are high. In addition, production per head is greater and costs associated with shearing, dipping and crutching are lower because of fewer head of stock.

The pasture condition, together with the condition of the soil and the limitations of the climate, determines the carrying capacity. Officers of the Soil Conservation Service of NSW are available to assess the carrying capacity of your property. If stocking rates are adjusted to these carrying capacities they should be able to be maintained for 12 months into a drought without causing damage to soils or pasture. **Destocking will be necessary if the drought continues.**

In determining the appropriate stocking rate, only the watered area of the property should be taken into account. Generally sheep will only walk about 3 km from water in saltbush and bluebush pastures during a drought. This is due to the very high salt content of these plants and consequently the stock need to water more often. The area which corresponds to a grazing distance of 3 km out from a watering point is 2800 ha, and this amount should be used in calculating stocking rates.

If the watering point is near a fence, the effective grazing area is less than 2800 ha (see diagram opposite). In good seasons, when a diet of saltbush and bluebush is supplemented with annuals, sheep will walk much further from the watering point, and perhaps even stay away for days. In cooler weather when water is available in puddles this can extend to months.

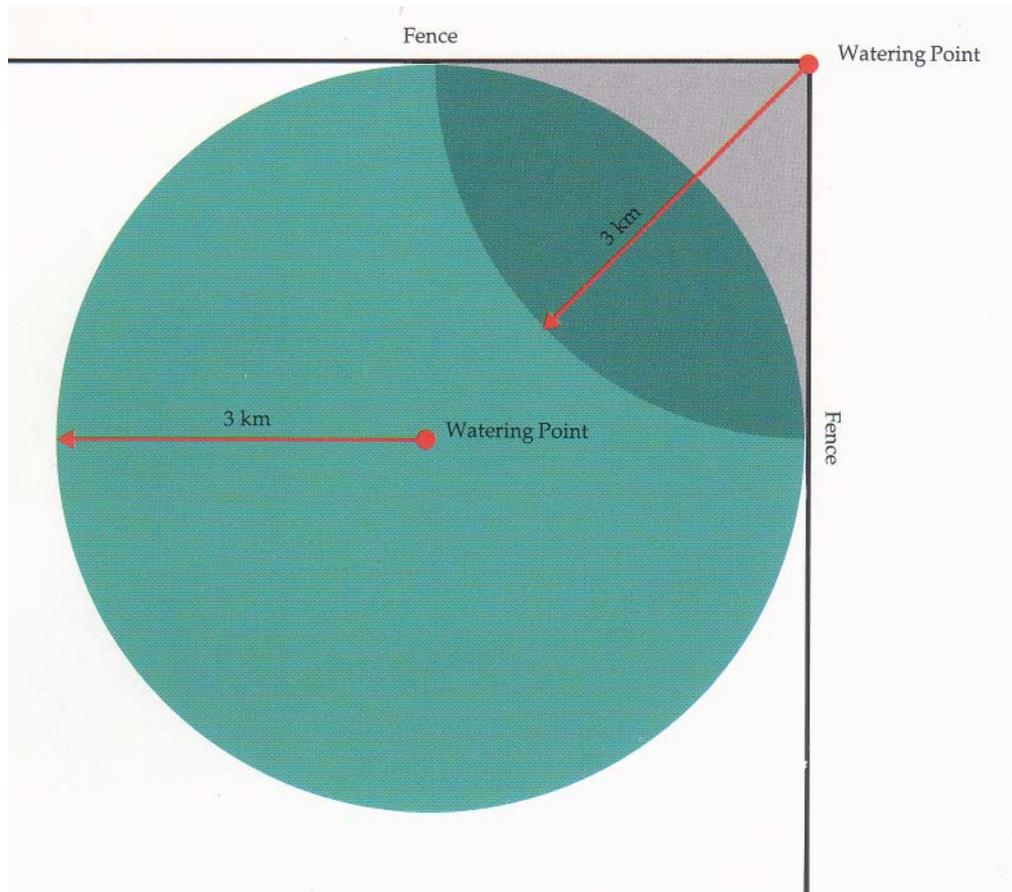
Research on the Mundi Mundi Plain has shown heavy grazing to have little effect on total cover of bladder saltbush, but a significant effect on age structure. That is, heavy grazing reduces the number of adult bushes and increases the proportion

of seedlings in the population. Ultimately, pasture degradation can result from the loss of mature plants.

Similarly, research on the Riverine Plain has shown that if adult saltbushes are being grazed down to about 30 leaves per plant, they are likely to die. Grazing rates causing this level of defoliation are too high, and a more moderate stocking rate is needed. Bluebushes can generally withstand heavier levels of defoliation than bladder saltbush but if defoliation is repeated and bluebushes are not given time to recover, they too are likely to be killed.

Most saltbushes and bluebushes actually respond better to moderate grazing than to low or no grazing. The bushes are more compact and vigorous if grazed moderately and tend to become straggly and rank if not grazed at all.

The grazing area around a watering point located in the corner of a paddock is only equal to 1/4 of the area around a centrally located watering point.



Grazing area of:



corner situated watering point

centrally situated watering point

Management in a drought

No matter how heavily or conservatively you stock there will come a time when you will need to reduce your stocking rate because of drought. **When to destock is one of the most crucial decisions facing you as a rangeland manager.** Unfortunately there are no hard and fast rules as to when is the right time to destock in a drought. The decision should be based primarily on the condition of the pasture and not only on stock condition. When your stock are showing poor condition it is probably already too late for your pasture. Some of the important signs that it is time to reduce stocking include:

- saltbushes and bluebushes are being grazed back heavily
- vegetation between the bushes is starting to disappear
- bladder saltbushes are noticeably shedding leaves
- soil surface is starting to break up close to watering points.

There is always the temptation to hold on to stock just a while longer because 'it's bound to rain next week'. Unfortunately that 'extra week' can make the difference between good pasture recovery after rain and long-term pasture degradation and soil erosion.

By reducing stock numbers relatively early into a drought, the pasture has the best chance of surviving the drought and recovering quickly once the drought breaks. Stock numbers can be reduced by selling some stock or by having them agisted. When selling stock, try to keep stock that have the greatest chance of surviving the drought and which are important to the quick recovery of production after the drought (younger breeding ewes). Stock that are diseased or aged should be sold first.

Post-drought management is equally critical. Drought breaking rains do not signal an immediate return to pre-drought conditions. Low stocking rates should be maintained to give the native pastures a chance to regenerate. For total regeneration of badly degraded vegetation, it may be necessary to reduce grazing pressure so that several seeding and/or seedling establishment events can occur.

IMPORTANT PERENNIAL PLANTS

bladder saltbush (*Atriplex vesicaria*)

A greyish-green bush growing to height of about 70 cm.

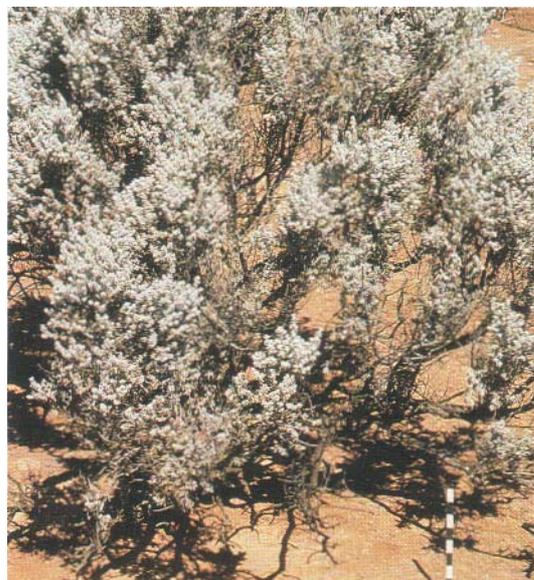
- A shallow-rooted species, although roots may spread out a considerable distance. As a result, bladder saltbush is best suited to soils which retain moisture in the upper layers, such as brown gibber soils.

Plants may live for 15 to 20 years if not stressed by drought or grazing.

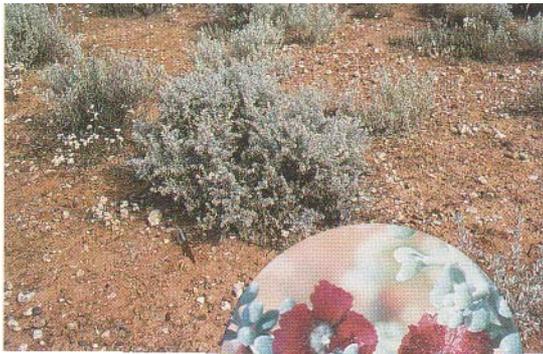
- The bladders or 'fruits' of the bladder saltbush contain the seed as well as salt. The seed will not germinate until the salt has been washed out by water. The amount of water needed to remove the salt is equal to about 50 mm of rain falling over 2 to 10 days.

The bushes generally seed over the summer and autumn, although if seasonal conditions are favourable, seeding may occur at any time of the year.

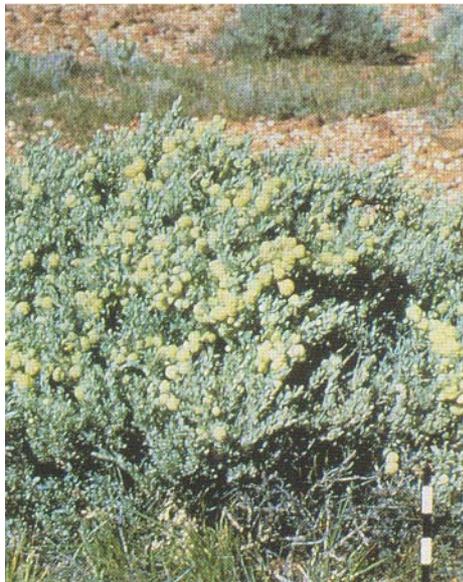
- Seeds are usually spread by wind, but are not normally blown very far. Generally seed accumulates under adult bushes, along with soil and other material. This provides an excellent seedbed for the establishment of young saltbushes.
- Germination of young plants most often occurs with late autumn and winter rainfall, but can take place at any time of the year.
- **A drought tolerant species.** It has a number of features in its leaves which allows it to reduce water loss through evaporation. In a very severe drought plants can shed their leaves, to further reduce water loss. This is a common occurrence in the downs country.
- Provides nutritious stock feed, but because of its low palatability, stock only eat bladder saltbush in any quantity when there is little other feed around. It provides a maintenance rather than a production diet, a sort of 'living haystack'. In a severe drought bladder saltbush cannot be relied upon to provide drought forage due to its habit of dropping leaves. However, even when in a leafless condition the bushes can still reduce wind velocity at ground level and protect the soil surface.



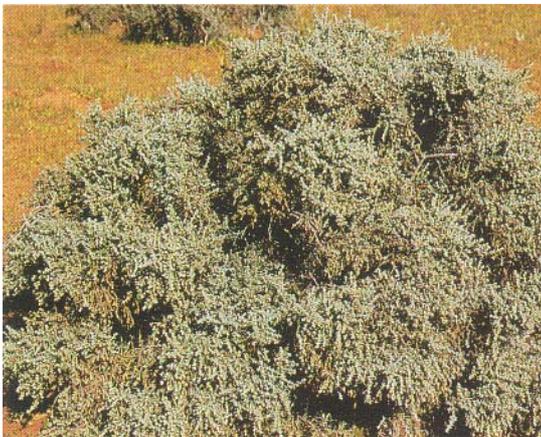
Bladder saltbush (*Atriplex vesicaria*). Photo: Plants of Western New South Wales



low bluebush (*Maireana astroticha*)
Inset photo: *Plants of Western New South Wales*



pearl bluebush (*Maireana sedifolia*) Photo: *Plants of Western New South*



black bluebush (*Maireana pyramidata*) Photo: *Plants of Western New South Wales*

- Bushes respond well to moderate grazing, becoming more compact and leafy than those only lightly grazed. However, continuous heavy grazing will lead to bush death. The chances of bush death increase as the number of leaves left on the bushes decreases.

low bluebush (*Maireana astroticha*)

- Bluish-white bush growing to about 1m high.
- Produces only small amounts of seed, reducing its chances of seedling establishment under grazed conditions. Plants are relatively slow growing.
- A very drought-tolerant plant.
- Nutritious, but relatively unpalatable, so that it is only grazed in dry periods when green feed is absent. It is a valuable drought forage plant. Valuable because of its ability to protect the soil against wind erosion.
- Suited to moderate grazing or intermittent heavy grazing, but is easily grazed out by heavy, continuous grazing.

pearl bluebush (*Maireana sedifolia*)

- Whitish-blue bush growing usually to about 1 m, but sometimes to 2 m, in height. Very similar in appearance to low bluebush, but can be recognised by the stalkless leaves (the leaves of low bluebush have stalks).
- Considered to be one of the longest living bluebushes, with a lifespan in excess of 150 years.
- It is a very slow growing plant. It produces seed at any time in response to adequate rainfall though it usually . only produces small amounts.
- Heavily grazed by rabbits during drought.
- Very drought resistant. The plant has the ability to absorb moisture from the air when conditions are very humid. In severe drought it can shed its leaves, without dying, to reduce water loss.
- Plants can withstand moderate grazing and occasional defoliation. However, continuous heavy defoliation will lead to its death and to replacement with less desirable species.

black bluebush (*Maireana pyramidata*)

- Blue-green bush growing to 1.5 m high.
- Summer rain is required for successful establishment and seeding.
- Long-lived and drought resistant. Black bluebush can maintain its leaves longer into a drought than bladder saltbush.
- Nutritious, but relatively unpalatable forage which is eaten by stock only during dry periods when alternative feed is absent. May be heavily grazed and ringbarked by rabbits, particularly during drought.
- Increases under moderate to heavy stocking rates, replacing more palatable perennial bushes such as low bluebush. In these instances black bluebush may act as a weed. However, continuous heavy stocking will eventually remove black bluebush.
- It is a valuable species for wind erosion prevention when bushes are no more than 3 m apart.

curly mitchell grass (*Astrebla lappacea*)

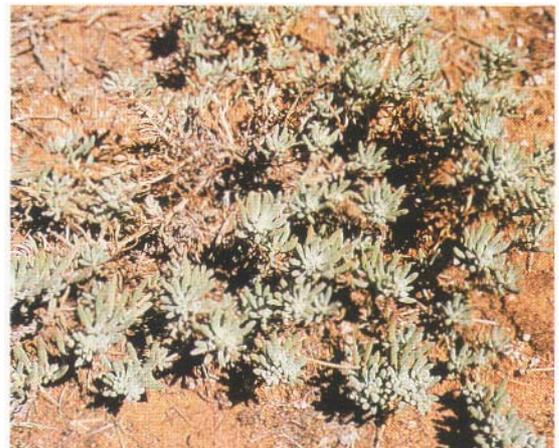
- A tussock grass growing to 80 cm high. Main growth period is summer with seed usually being shed by the end of May.
- Occurs throughout the downs country, but is more common in the northern areas where there is a higher incidence of summer rainfall.
 - Nutritious and palatable when green. The nutrient value decreases with drying off but mitchell grass remains an important forage during dry periods when more palatable plants have disappeared.
- The plants are able to survive drought and reshoot quickly after drought-breaking rains.
- Mitchell grass is favoured by light to moderate grazing. However, continuous heavy grazing exhausts the plant's reserves and results in a reduction in butt size, and in the worst case, its complete removal.
- Occasional burning of mitchell grass has no effect on the density of plants and in some cases may stimulate growth if favourable seasonal conditions follow.



curly mitchell grass (*Astrebla lappacea*) Photo: *Plants of Western New South Wales*

copperburrs (*Sclerolaena* spp.)

- Small forbs which grow to a height of between 15 and 50 cm.
- The most common copperburr species of the downs country include short-winged copperburr (*Sclerolaena brachyptera*), silky copperburr (*S. eriacantha*), limestone copperburr (*S. obliquicuspis*), grey copperburr (*S. diacantha*) and woolly copperburr (*S. lanicuspis*).
 - They provide relatively nutritious feed but are usually only selected by stock in dry times when more palatable annual plants have dried off.
- Heavy stocking rates will decrease the abundance of copperburrs and encourage the invasion of less palatable plants.
- Grey copperburr and short-winged copperburr are capable of colonising bare scalded areas.



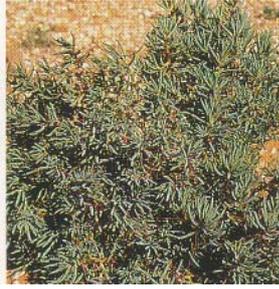
grey copperburr (*Sclerolaena diacantha*) Photo: *Plants of Western New South Wales*

short-winged copperburr
(*Sclerolaena brachyptera*)
Photo: *Plants of Western*





pale poverty bush
(*Sclerolaena divaricata*).
Photo: *Plants of Western
New South Wales*

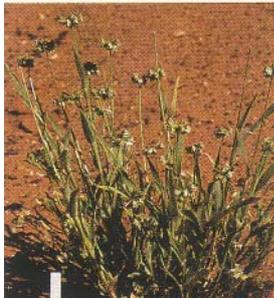


long-spined poverty bush
(*Sclerolaena longicuspus*)
Photo: *Plants of Western New
South Wales*



mulka (*Eragrostis dielsii*) Photo: *Plants of
Western New South Wales*

button grass
(*Dactyloctenium radulans*).
Photo: *Plants of Western New
South Wales*.



bottlewashers (*Enneapogon
avenaceus*) Photo: *Plants of
Western New South Wales*



windmill grass (*Chloris
truncata*) Photo: *Plants of
Western New South Wales*

poverty bushes (*Sclerolaena spp.*)

- Small short-lived bushes from 30 to 70 cm in height.
- The poverty bushes are members of the same family as the copperburrs, but all have sharp spined fruits which greatly reduce their acceptability to stock.
- The most common poverty bushes of the downs country include pale poverty bush (*Sclerolaena divaricata*), long-spined poverty bush (*S. longicuspis*) and streaked poverty bush (*S. tricuspis*).
- Poverty bushes increase in density in overgrazed pastures, replacing the more palatable bushes and perennial grasses.
- They have some value in being able to colonise bare, eroded areas.

mulka (*Eragrostis dielsii*)

- A short-lived grass, spreading, to 30 cm in height.
- Summer growing and produces large amounts of seed.
- Common on areas of light soils with bluebush.
- Valuable, producing large amounts of palatable forage.
- A useful soil binder.

IMPORTANT ANNUAL PLANTS

button grass (*Dactyloctenium radulans*)

- 10 to 20 cm in height. Fast growing and matures rapidly. Its main growth period is summer.
- Palatable and nutritious forage.
- Known to cause stock poisoning when hungry sheep are grazed in a paddock of lush green button grass.

IMPORTANT FACULTATIVE PERENNIAL PLANTS

common bottlewashers (*Enneapogon avenaceus*)

- Loosely tufted grass growing up to 30 cm in height.
- Summer growing. It may dominate large areas after a run of good summer rainfall years.
- Not drought resistant.
- Palatable and readily grazed-the nutritional value is sufficient to fatten stock, but decreases as the grass hays off.
- Heavy grazing during the summer may reduce the amount of bottlewashers present, but, more importantly, will reduce the amount of seed produced and therefore limit next year's plant population.

windmill grass (*Chloris truncata*)

- Facultative perennial grass growing to a height of 15 to 45 cm.
- A summer-growing species which seeds prolifically. Dries off during dry periods and droughts.
- Provides very palatable and nutritious forage which is readily grazed by stock.
- Responds to heavy grazing by increasing in density, often replacing less grazing-resistant plants such as bladder saltbush.
- One of the first grasses to colonise bare areas.

SOILS

Numerous soil types occur within the downs country. Most common are the brown gibber soils, desert loams and texture contrast soils. Lithosols, heavy clays, solonised brown soils and soft red earths occur to a lesser extent. The major characteristics of each of these soil types are given below.

brown gibber soils

- Characterised by a shallow loam to clay topsoil with a surface layer of polished stones (gibbers).
- The topsoil changes abruptly to a stone-free, coarsely structured clay subsoil.
- Often found within the upper slopes of the downs country.
- May or may not exhibit contour gilgai patterning (alternating bands of bare, stony soils with vegetated, slightly depressed and less stony soils which follow the contour).
- Highly susceptible to water erosion (sheet and gully) if the surface pavement is disturbed.

desert loams

- These soils are similar to brown gibber soils but lack a stone pavement (although a light covering of gravel may be present).
- Usually found on lower slopes within the downs country, often closely associated with brown gibber soils.
- The clay subsoil has a high water holding capacity.
- Prone to sheet erosion by wind and water, scalding and gullying if the shallow topsoil is disturbed.

texture contrast soils

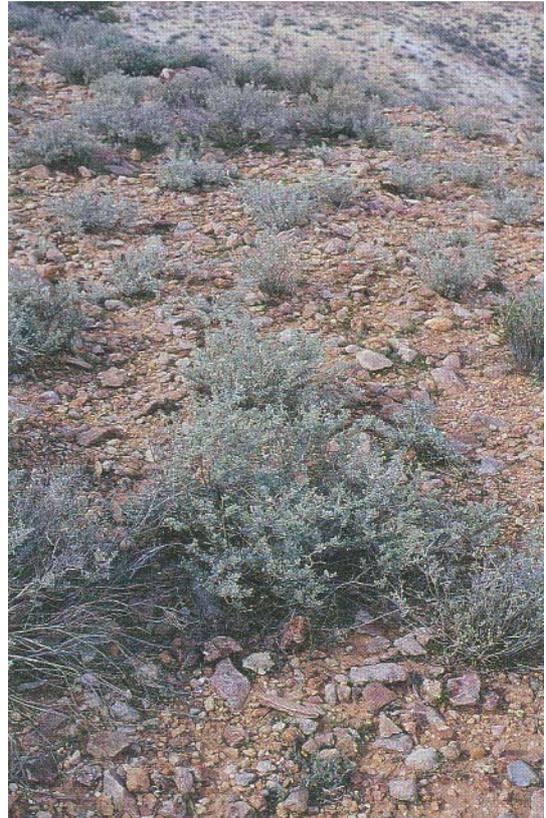
- Characterised by an abrupt change in structure and texture between the topsoil and subsoil.
- The topsoil is usually a sand or loam underlain by a clay subsoil.
- Most common along creeks within the downs country.
- Highly susceptible to windsheeting and scalding.

lithosols (skeletal soils)

- Associated with the higher hills and ranges of the downs country.
- Shallow, poorly developed soils, often gravelly or rocky.
- Prone to sheet or rill erosion by water if the protective vegetation or rock cover is removed.

heavy clays

- Generally very deep soils with a well developed structure, and generally little change in texture or colour with depth.
- Usually associated with floodout areas or the depression area of gilgais.
- Waterholding capacity is very high, but vegetation response to light showers of rain is poor.
- Erosion hazard is low due to the well structured surface and level topography, although stock trampling may lead to the formation of scalds.



Bladder saltbush (*atriplex vesicaria*) growing on brown gibber soil. Note the protection offered by the surface gibbers against erosion.



Bladder saltbush (*Atriplex vesicaria*) growing on desert loam soil.

solonised brown soils

- Common throughout the sandplains.
- Sandy to loamy with lime present as nodules or in a powdery form throughout the profile. Water infiltration rates are high, but waterholding capacity is poor. Susceptible to sheet erosion and drift.

soft red earths

- Occur throughout the downs country, particularly in the transitional zone between mulga rangelands and downs country.
- Texture ranges from sand to clay loam, usually poorly structured.
- Not calcareous at the surface.
- High water infiltration, but poor to moderate water holding capacity.
- Susceptible to drift and sheet erosion by wind and water.

OTHER WAYS OF IMPROVING YOUR PROPERTY

Although variation in grazing rates is the main way in which you can manage your pastures and protect your soil, there are additional methods you can use to improve your property.

Watering points

In saltbush and bluebush pastures a supply of stock water low in salinity is important as these pastures are very high in salt content. Sheep, and to a greater extent cattle, are less tolerant of saline drinking water when on a diet of saltbush and bluebush.

The quantity of water consumed by stock increases as seasonal conditions turn dry and the amount of saltbushes and bluebushes in their diet increases.

In summer, the grazing range of sheep is only about 3 km from water and they may have to return to water twice a day, so the areas close to watering points may be overgrazed. To minimise grazing intensity on bushes and perennial grasses and maximise pasture utilisation, watering point spacing should be such that all areas within a paddock are within 3 km of a watering point.

Watering points that are situated centrally in a paddock allow the maximum use of pastures. Watering points situated in corners of paddocks offer significantly reduced grazing areas. Although it is cheaper to set up watering points in the common corners of adjacent paddocks, the availability of polythene pipe makes the establishment of watering points centrally in paddocks a relatively cheap proposal and one which will pay off in the short term by way of better pasture utilisation and condition.

Watering points in the south-east and south-west corners of paddocks should be avoided as stock naturally graze into the prevailing winds and will tend to concentrate in this area of the paddock for longer periods.

As the area of greatest stocking pressure occurs around watering points, care should be taken to site them away from areas most susceptible to soil erosion. The high risk soils include texture contrast soils, solonised brown soils and soft red soils. However, where excessive grazing is allowed to occur around a watering point, some degree of erosion can be expected on most soils of the downs country.

EROSION

All soils of the downs country are prone to some form of erosion. Erosion can be conspicuous as in the case of gullying and bare unsightly areas of scald or, as in the case of sheet erosion, less obvious despite the loss of soil particles and important nutrients and seeds. **All forms of soil erosion are alike in that they reduce the ability of your pastures to produce to optimum levels.**

The most likely time for erosion to occur is during and following a drought, when vegetation cover is at its lowest level. Water erosion most often occurs with drought-breaking rains, so it is important to maintain as much vegetation as possible at this time.

The most common forms of erosion in the downs country are sheet and gully erosion. Smaller areas are susceptible to scalding and drift.

Sheet erosion: may be caused by the action of water or wind. **Sheet erosion by water** is most common in the downs country. It is the removal of a fairly uniform layer of topsoil by rainfall and runoff water. Whilst the total amount of soil loss may be relatively small, the major damage is loss of plant nutrients and exposure of soil less suitable for plant growth, making future plant establishment difficult. **Sheet erosion by wind** is the removal of thin sheets of soil by the action of wind. The resulting surface has a swept or baked appearance, but is generally not very different from the original uneroded surface. Some loss of nutrients and water-holding capacity occurs, but given reasonable seasonal conditions, the original plant species should be able to re-establish on the site.

Gullying: generally occurs on sloping land, when runoff water is concentrated into drainage lines or artificial channels such as vehicle tracks. This leads to deeply incised channels, or gullies, in the land. Once gullying has begun it takes only small showers of rain to produce an increase in gully size. A further problem is created by the deposition of the eroded sediment against fencelines, on roads and over previously productive country downslope.

Scalding: the removal of the sandy topsoil by wind and/or water to leave a smooth and relatively impervious clay subsoil at the surface. The smooth surface makes it difficult for any seed to lodge on the scald. This greatly decreases the chance of natural revegetation.

Drift: the build up of windblown sediment against obstacles such as fences and vegetation. Apart from the loss of valuable soil material from the eroded site, drift material can cause destruction of adjacent vegetation due to sandblasting and burial, and render fences useless.

Vegetation cover is the factor that is most useful in preventing all these types of erosion. In particular, a perennial vegetation cover, rather than one that is present only in favourable months, is important for soil protection. Most wind erosion damage occurs during droughts when vegetation cover is at its lowest, and soils have dried out. The greatest risk of water erosion occurs with drought-breaking rains, when vegetation cover is at a minimum. **The greater the cover of perennial plants, the less is the chance of erosion damage to your country.**

Tracks

Care needs to be taken in siting tracks to minimise erosion risk. Badly sited tracks are the cause of many of the eroded gullies within the downs country. You should aim at minimising soil and vegetation disturbance by only grading the surface vegetation where necessary.

Tracks should follow the contour of the land as closely as possible, to reduce drainage problems created by wheel ruts, and should cross drainage lines at right angles. Where possible, steep slopes and swamps should be avoided. If tracks are sited along depressions, they may act as drainage lines, causing severe gully erosion.

Contour furrowing

For country which has suffered sheet erosion, scalding or just pasture deterioration, contour furrowing is an efficient method of reclamation.

Furrows are constructed on the contour using a modified mouldboard plough. The horizontal spacing between furrows varies from 7 to 15 m depending on slope and soil type. Furrows decrease the amount and speed of surface water flow, trap sediment and seed carried by water and wind, and markedly increase water infiltration into the soil.

Furrowing creates a suitable seed bed and an increased water supply for plants (furrows are capable of retaining 5 times the actual rainfall). Contour furrowing also reduces the potential for both wind and water erosion.

When an adjacent stand of perennial bushes or grasses is present to provide seed, furrowing alone may be sufficient to promote perennial vegetation establishment. Where possible, reclamation should be initiated at the first signs of pasture or soil deterioration while a seed source is still present. When a seed source is absent, quicker results are obtained by sowing into the furrow. To date, the best results have been obtained by using the seed of species naturally occurring in the area such as bladder saltbush, black bluebush and mitchell grass.

The success of contour furrowing, as with any reclamation technique, depends on ongoing judicious stocking and sound property management. Further advice and furrow survey assistance is available from the Soil Conservation Service of NSW.

Rabbit control

Rabbits can present a major problem to the landholder for two reasons. They compete with stock for vegetation, often leaving the country bare and vulnerable to erosion. There is also an additional erosion hazard caused by the individual burrows and warrens.



Contour furrowing can improve the productivity of your eroded or degraded country.

Erosion, such as gullying and scalding, can be very obvious and results in an important loss of production.



A good mix of perennial grasses and bushes will protect soil from erosion.



The protection offered to the soil by the perennial vegetation on the left side of the fence is much greater than that offered by the few scattered plants on the right side of the fence.



Rabbits are most common on deep, calcareous soils such as solonised brown soils, on sandy rises and on texture contrast soils. The latter two are most commonly associated with creeks. Warrens may also be indicated by the presence of tobacco tree (*Nicotiana glauca*). Control of rabbit populations is essential if stock are to get the most use from your pasture.

Deep ripping using a crawler tractor is an effective method of rabbit control. Ripping should be undertaken over as large an area as possible to minimise the chance of reinfestation from adjacent, undisturbed warrens.

Follow-up ripping or poisoning and fumigation is also necessary to prevent rabbit reinfestation. Information on poisoning and fumigation is available from your local Pastures Protection Board.

Tree Establishment

As sheep will often walk long distances to find shade in summer, trees can be used to even out grazing and therefore pasture use, and help to maintain stock condition in very high temperatures.

Tree planting is not a realistic option in most of the arid downs country. Where trees already exist, areas should be fenced off from grazing to allow natural regeneration.

THE DOWNS ECOSYSTEM

Productivity of the downs country is closely associated with rainfall and the amount of water the soil can store. The greater the amount of vegetation, the greater are the rates of water infiltration into the soil. Soil erosion decreases the amount of infiltration into the soil, which in turn reduces the chance of plant establishment. Erosion can be self-perpetuating.

The **contour gilgai pattern**, visible as bands of vegetation between bare, stony areas, is present in some areas of brown gibber or desert loam soils. It plays a very important role in the redistribution of rainfall. The bare areas have very low infiltration rates and shed water into the slightly depressed vegetated areas below. This increases the amount of water received by the vegetated areas to more than the measured rainfall. On a broad scale, the increased amount of vegetation which can be supported in the depressed areas is greater than the amount which could be produced if the distribution of water over the whole area was more even.

Contour banding is also important in reducing the impact of water erosion since the depressed areas slow down the rate of rainfall runoff and thus reduce its impact. In contour-banded areas it is very important to maintain the natural proportion of bare to vegetated areas in order to maximise vegetation production and minimise erosion.

Response to rain in different seasons

Pasture species from the downs country are adapted to low soil moisture and will grow after rain at most times of the year. Good seasonal rains produce dramatic changes in the appearance of the pasture.

Warm season (October to March) rain encourages the growth of summer grasses such as common bottlewashers, windmill grass, button grass, mulka and the perennial mitchell grass. As well, warm season rain promotes the growth of perennial bush species such as bladder saltbush, low bluebush and pearl bluebush.

Cool season (April to September) rain creates a response in species such as eastern flat-top saltbush and pop saltbush, blue crowfoot, new zealand spinach, common white sunray and arabian grass (*Schismus barbatus*).

If similar seasonal conditions prevail for a couple of years in a row a marked shift in the dominant plant species may occur. For example, a series of good summer rainfall years may produce a dominance of mitchell grass within the pasture. Similarly, a series of good winter rainfall years will encourage a pasture dominant in bladder saltbush and cool season species.

Saltbushes and soil nutrients

Bladder saltbush plays a key role in nutrient cycling within the downs country. Most of the nitrogen and phosphorus is concentrated in the plant roots and topsoil. The level of nitrogen is closely related to bush presence, with higher concentrations found in the soil directly beneath bushes compared to the area between bushes. Organic matter levels are also higher beneath bladder saltbushes due to their ability to trap windblown soil particles, plant debris and seed.

The removal of saltbushes through heavy grazing or other means does not result in the even redistribution of nutrients across the whole area. Whilst the coarser soil particles may be moved from under the bushes to the intervening areas, the finer nutrient-rich particles are winnowed out by the wind and lost as dust, or are washed away by water.

Effects of fire

Fire is a destructive force in saltbush and bluebush pastures. An intense wildfire will destroy the bushes and sometimes the seed source so that the regrowth of saltbush and bluebush after fire can be a very slow process.

However, it is only in a dry year following a run of extremely good seasons that fuel levels are sufficient to carry a wildfire.

In mitchell grass pastures the effect of fire depends largely on seasonal conditions following the burn. If conditions following the burn are favourable, a significant decrease in the number of plants or their vigour is unlikely. In fact, the growth of mitchell grass may be stimulated. However, if extended dry conditions follow a fire the result may be a reduction in both plant numbers and vigour.

WHAT IS THE CONDITION OF YOUR PROPERTY?

The plants of the downs country exist in a balance with each other as they compete for moisture and nutrients. Change in condition or pasture 'health' occurs when some factor such as overgrazing upsets this balance. Changes can be gradual and thus difficult to pick up. Often this can accelerate if the pressure which caused the initial upset is sustained.

The proportion of **increaser to decreaser** species (commonly known as **indicator** species) tells us something about the condition of the pasture. Changes in a pasture due to overgrazing show up as a decrease in desirable species (decreaser species) and an increase in less desirable or weed species (increaser species). A shift in this direction represents a loss of pasture condition or health.

Some decreaser species are more susceptible to grazing than others and therefore disappear more quickly from the pasture.

Increaser species generally have a shorter lifespan than decreaser species because they are less tolerant of unfavourable climatic conditions and only grow under good moisture conditions. This means that they are not present when plants are needed most for soil protection and drought forage. As well, they may be unpalatable or poisonous to stock.

Under heavy grazing, the decreaser plants are eaten in preference to the increasers which benefit by the lack of use. Hence, increasers can compete more successfully for water and nutrients and so eventually come to dominate the pasture.

Contour banding (seen here as a series of bare and vegetated areas) plays an important role in redistributing rainfall and preventing water erosion.



Assessing condition

Being aware of range condition is a matter of knowing:

- what it is like now
- what its potential is
- whether or not it is changing
- if changing, whether the trend is upwards (improving towards its potential) or downwards.

The perennial saltbushes and bluebushes, and grasses such as mitchell grass are among the most important plants in the paddock. It is important to be aware of the amount of cover they provide and their general health.

Downs country in good condition will have a good mix of perennial saltbushes and bluebushes with copperburrs and a range of palatable annual herbs and grasses. Mitchell grass may also be present between the bushes.

Country in poor condition may have a dense cover of poverty bushes, which are unpalatable to stock, or it may support a range of annual species with few perennial bushes or grasses. This type of pasture generally offers good production during good seasons, but when conditions dry out, little or nothing is left to carry stock or protect your soil.

High densities of black bluebush, the least palatable of the bluebushes, may also represent a decline in range condition. Although black bluebush offers soil protection in dry periods, it is generally a poor substitute for the more palatable saltbushes and other bluebushes that it tends to replace.

Early detection of declining pasture condition and an appropriate adjustment in stocking rate can help you to avoid serious vegetation decline and soil deterioration.

There are several points to look for when determining condition. You have to assess the number of different species present (species diversity) and the condition of the soil surface, as well as deciding which of the two types of plants, increasers or decreasers, are making the major contribution to the pasture.

Soil surface condition relates to three major factors:

- the presence or absence of an intact surface lichen crust
- the amount of bare ground
- the amount of soil movement.

A soil surface in good condition is one which has an intact surface lichen crust, little bare ground and little evidence of soil movement.

The country can be classified as being in good condition if decreaser species are the most common plants and the soil surface is in good condition. The rating can decrease for a number of reasons: as the proportion of increasers and invaders (weeds) rises; as species diversity declines; or as soil surface condition deteriorates.

Some of the decreaser species of the downs country include:

bladder saltbush	<i>Atriplex vesicaria</i>
ruby saltbush	<i>Enchylaena tomentosa</i>
thorny saltbush	<i>Rhagodia spinescens</i>
low bluebush	<i>Maireana astrotricha</i>
pearl bluebush	<i>M. sedifolia</i>
cottonbush	<i>M. aphylla</i>
mitchell grasses	<i>Astrebula spp.</i>
common bottlewashers	<i>Enneapogon avenaceus</i>
native millet	<i>Panicum decompositum</i>
curly windmill grass	<i>Enteropogon acicularis</i>
copperburrs	<i>Sclerolaena spp.</i>

Some of the increaser species of the downs country include:

eastern flat-top saltbush	<i>Atriplex lindleyi</i>
pop saltbush	<i>A. spongiosa</i>
kerosene grass	<i>Aristida contorta</i>
windmill grass	<i>Chloris truncata</i>
button grass	<i>Dactyloctenium radulans</i>
cannonball	<i>Dissocarpus paradoxes</i>
new zealand spinach	<i>Tetragonia tetragonioides</i>
black bluebush	<i>Maireana pyramidata</i> (increases under moderate grazing but becomes a decreaser species under heavy grazing)
poverty bushes	<i>Sclerolaena spp.</i>

If you are unsure of the identity of any of the plants in your pasture, look them up in *Plants of Western New South Wales*, or take them in to an office of the Soil Conservation Service nearest you. The Soil Conservationists there can not only identify them for you, they can also tell you whether the plants are useful or not.

Monitoring condition

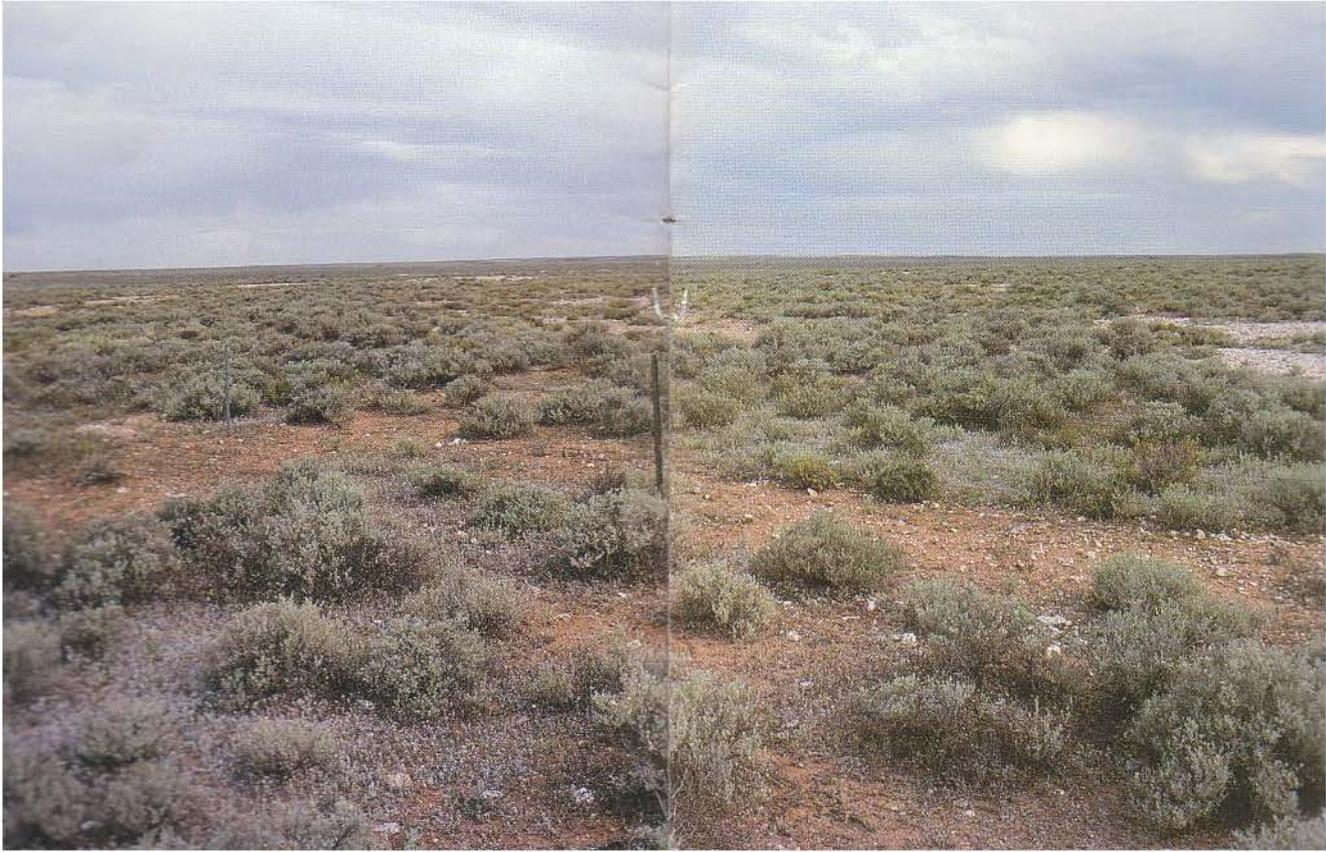
Range condition determines the number of stock which can safely be carried in a paddock. Therefore, it is important for you, as a range manager, to be able to assess the condition of your property if you are to use it within its capacity without causing deterioration of your vegetation or soil. **By assessing range condition over a period of time you will be able to tell if current management is improving or causing deterioration of range condition.**

The changing condition of your pasture can be monitored by taking photographs and step-pointing. Gradual changes and details that may be overlooked in casual observations are recorded by these techniques. The main requirements when taking a photo in a paddock are to take it at the same spot, in the same direction, with the same lens and at the same angle each time. To do this it is necessary to mark a permanent site (photopoint). Photographs are only a 'broad brush' record, since significant change in pasture condition will usually be masked by purely seasonal changes. Additional information can be determined by step-pointing, a method of estimating vegetation cover that is sensitive enough to identify significant changes in vegetative composition. Step-pointing involves pacing along a line and recording the ground cover directly under a mark at the toe of your boot at each step. Further details on photo-assessment and step-pointing can be found in Range Note No. 4, *Pasture Assessment Guide for Graziers*, available from the Soil Conservation Service.

If you assess condition too close to a watering point your country may appear to be in worse condition than it really is. The best place to assess condition is about 1.5 km from a watering point-any further than this and you begin to assess country that is only lightly grazed.

The condition and productivity of your stock and the stability of your soils are directly dependent on the health of your pasture. It is often too late to adequately resolve a problem if you wait until stock condition starts to deteriorate. It is far better to be able to act as soon as pasture condition is seen to decline. Better still, act now to improve your pasture condition. In this way you are safeguarding your stock as well as your basic resources-the pasture and the soil.

Taking into account the condition of your pasture and the management practices you are using ...**HOW DOES YOUR COUNTRY RATE?**



Good, moderate and poor bladder saltbush pastures.



INFORMATION AND ASSISTANCE

A wide range of assistance is available to you as a rangeland manager. The Soil Conservation Service has produced a number of publications relevant to rangeland management. These include:

- *Plants of Western New South Wales*—a comprehensive, illustrated account of the plants of the area.
- *Range Notes*—leaflets covering topics relevant to western NSW such as stocking rates, pasture assessment and soil types.
- *Soil Notes*—leaflets on a range of topics, including wind erosion and fire control of woody weeds.
- *Rangeland Reviews*—reviews of information relevant to the various types of rangeland in western NSW.

In addition, soil conservationists are available to give professional advice on any matter relating to soil and land management. This includes:

- The preparation of Property Plans, which show land types, fences, watering points and tracks. They also contain a report which describes land types, suggests land management options and assesses carrying capacities.
- Plant identification.
- Advice and assistance with rehabilitation.
- Advice and assistance with farm water supply needs.

As well, there are several other publications that may be helpful:

- *Management of Australia's Rangelands* by G.N. Harrington, A.D. Wilson and M.D. Young. CSIRO. Chapter 14 (on saltbush and bluebush rangelands) is particularly recommended.
- *The Use of Trees and Shrubs in the Dry Country of Australia* by N. Hall and others. Australian Government Publishing Service. This book contains a wealth of information on Australian arid and semi-arid lands.